MILL SECTION of
Concrete

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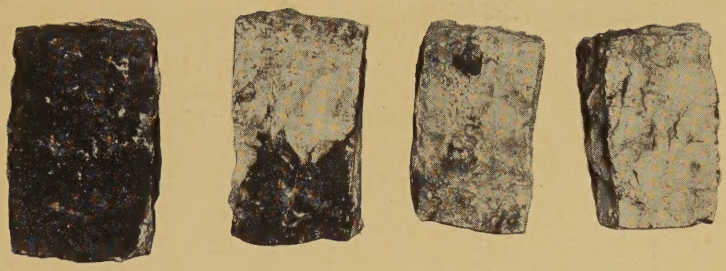
TUBEMILL LININGS

Silex



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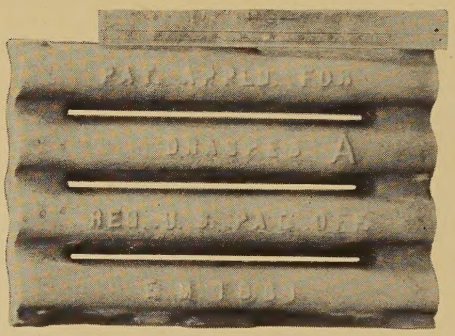
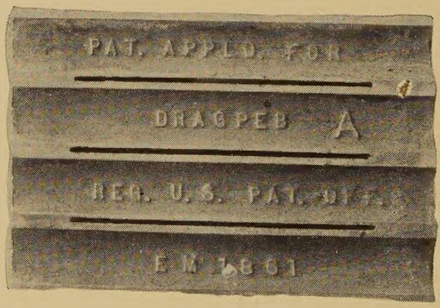


Wearing Surface



Bearing Surface

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MILL SECTION of
Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

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MILL SECTION of

Concrete

Vol. 32 Chicago, January, 1928 No. 1

Power Plant and Kiln Design and Operation

A Summary of the Series of Articles Published Under That Title in Previous Issues

THE cement industry has a very real manufacturing problem to face in adapting itself to the production of the improved quality cements now being demanded.

NOTHING is to be gained in dodging the facts. The situation should be squarely met and the facts considered from all angles.

THE increased cost of the improved quality cements may be offset by manufacturing economies which have been demonstrated in a practical way.

THE burning of the clinker and the generation of power probably offer the greatest opportunities for economies at the present time.

IN an effort to show where and how some of these economies can be effected, the series of articles on Power Plant and Kiln Design and Operation were published. They have created a great deal of interest and it has seemed advisable to review them and to discuss some of the comments made.

THE following article, by T. H. Arnold, co-author with R. Coghlan of the series, is a summary of the principles of cement plant operation presented in those articles.

By T. H. ARNOLD

IN studying the real advances made in the process of manufacture of portland cement it is evident that the greater portion of them may be credited to the efforts of a few individuals who have painstakingly sought out fundamental tendencies and followed their trend. The history of the industry records many spectacular failures resulting from attempts to carry out ill conceived ideas which were based on inaccurate deductions and doomed to failure from the start. Unfortunately the cement industry is hampered by the small amount of fundamental information which has been published covering the mechanical processing of the material. Considerable attention has been given to the chemical processes and to the physical characteristics of the product. The majority of the published material on the processing has been in the nature of descriptive narratives or manufacturers' estimates of operating results which did not include sufficient information to predict accurately the results which could be attained under altered conditions.

It was in the hope that a little light thrown upon some of the basic principles underlying the processes of the industry would assist in the solution of the problems of others in the industry that the authors placed some of their notes in form for the chapters which have been published under the title "Power Plant and Kiln Design and Operation." Some of the data and deductions were original with the authors. Much of it, however, was gleaned from various sources some of which were rather unexpected. A few inaccuracies have crept in, and in places the text has not been entirely clear. It has been the intention to present the information in usable form. However it is not possible to present such information in so simple a manner that it will not require some effort on the part of the reader to absorb it in sufficient detail to make use of it. The material is thus dedicated to those individuals who are interested in the development of the industry and possess the necessary energy and tenacity to study and make the information a part of their working knowledge.

Throughout the discussion it has been the intention to bring out constantly the interdependence of the various processes and departments. The problems of no one department or of one single process in a department may be considered separately without the possibility of overlooking some point of vital importance. This has been one of the most fruitful sources of failure in working out plans based on studies of one phase of a process. It is entirely possible to so contract the vision in the scrutiny of a small point that we lose its relationship to the whole. As our industrial processes become more involved and the plants become larger, this phase of industry becomes more accentuated. The more clearly this complex nature is visualized in the technical studies the more nearly will the solution fit the conditions actually existing.

Improvement in Cement Quality

The cycle of change in the manufacture of portland cement has brought the demand for an improvement in quality as an accepted fact. The problem now to be faced by the manufacturers is double; how far shall the improvement in quality be carried and how can the individual plant make the improved cement at a profit. The method of meeting this changing demand will vary with the characteristics of the individual management. Like the ostrich, it is possible to bury one's head in the sand and ignore such changing tendencies. Like the ostrich, also, the caravan will have passed by the time the head is removed from the sand.

It is possible to publicly deny the very existence of such a problem while at the same time bending every endeavor toward preparing one's own plant for the production of the improved material. This attitude deceives no one but the one attempting to gain an advantage over his competitors. Such a course will produce an unhealthy condition that breeds distrust and suspicion and results in disastrous competition.

There remains a broad viewpoint involving a frank exchange of research information and basic technical studies throughout the personnel of the industry. The first result of the adoption of this policy in other industries has been the discovery of the fact that many of our carefully guarded secret processes were duplicated in a similar manner by our competitors. This situation is being faced by the industry as a whole and not by any one plant. There can be only one successful answer to the problem. To compensate for the increased manufacturing cost of the improved product, we must introduce economies and recover waste materials in sufficient quantities to reduce the manufacturing cost to the previous basis. The situation allows no chance for equivocation and all such economies must be based upon absolute facts which may be demonstrated instead of estimates by so-called experienced individuals.

Fuel Cost is Biggest Item

Anyone familiar with cement plant cost sheets will know that fuel for burning is the largest single cost item. Second comes the item of power. Naturally any investigation looking toward possible savings in manufacturing costs will start with the larger items where the possibilities of savings are largest. Fuel for burning and the generation of power were thus selected for consideration in this discussion.

Every engineer who has made studies of the use of fuel in any of the American industries has been appalled at the magnitude of the waste in its utilization. It is true that we have made considerable progress in curbing this waste but it is generally conceded that there is great room for the young engineer in the further reduction of this waste. Waste products can only be utilized as economic conditions render their recovery justifiable with a reasonable capital outlay. The reduction of fuel consumption to a minimum and the subsequent recovery of a large portion of the unavoidable waste in useful form, thus form the basis for a highly successful program of cost reduction.

The determination of the economic limitations of the process and the accurate analysis of the heat disposition is highly necessary as a basis for the determination of those measures which may be successfully applied to accomplish these results. The degree to which these factors have been considered will largely decide the economic success of the measures applied. The theoretical discussion presented in the series of articles referred to was rather complete. Therefore the following summary will merely call attention to the salient points and only elaborate in a few instances where communications have been received indicating a lack of clarity in the original text. As the original notes were not prepared in any particular order, the summary need not follow the order of publication.

Recovering Heat

A careful analysis of the heat utilization in the process of burning portland cement clinker will show that only a small portion of the heat is absorbed in a manner which is not recoverable. That portion which is required for the calcining of the lime and magnesia is absorbed in the chemical change and is thus not recoverable. On the other hand some heat is evolved in the combination of the silicates. Thus, if we could operate the process with perfect fuel efficiency we would have heat requirements as follows:

	B. t. u.
Heat required for calcining raw material per bbl.	368,000
Heat from combination of clinker per bbl.	65,000
Heat to be supplied in non-recoverable form per bbl.	303,000

On the basis of 13,000 B.t.u. per pound coal, we would thus require 23.3 pounds per barrel for burning.

In the early development of the industry the vertical kiln was brought to a point which closely approached this efficiency. Today in Europe where labor is low in cost and fuel costly, the vertical kiln is used to a large extent. In America changing economic conditions rendered the labor cost exorbitant while fuel was abundant and low in price. When the rotary kiln was introduced it was realized that the substitution of the rotary kiln for the vertical kiln was accompanied by a large increase in the fuel required for burning. The savings in labor and the advantages in the continuous process, coupled with the greater unit output, justified the change. Economic conditions have continued to change. Today fuel as well as labor is being considered as a means for possible savings. As it is the largest single item composing the cost, it is also the most promising subject for investigation in the eternal struggle for cost reduction.

To accurately determine where the fuel costs may be reduced we must ascertain accurately just where the heat is now going and how far it may be economically reduced at various points. The greater portion of the heat will leave the kiln at the following points:

1. Heat carried from the kiln with the clinker.
2. Heat radiated from the kiln shell.
3. Heat absorbed in the calcination of the lime and magnesia.
4. Heat absorbed in the latent heat of evaporation of the water both from the fuel and the raw material.

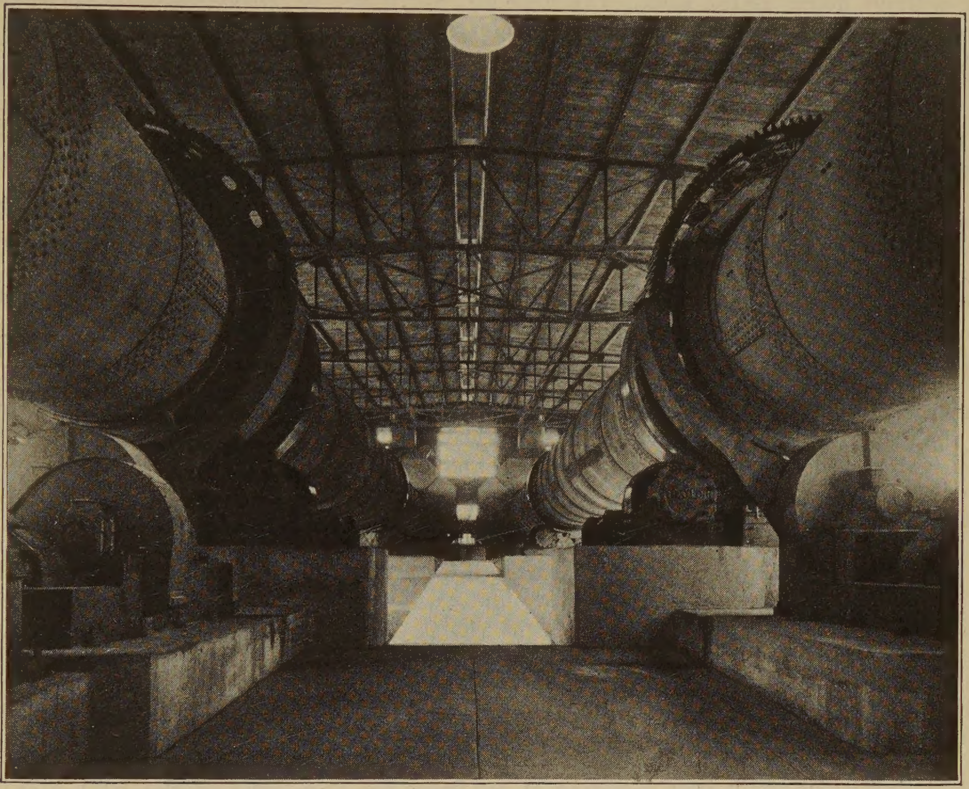
5. Heat carried with the waste gases of combustion.

Of the above items, 1, 2, 4, and 5 may be materially reduced or partially recovered by means now commercially available. Item 3 is inherent in the process and may only be reduced by utilizing materials which do not require calcination, as in cement made from steel slag.

Heat Losses

The relative value of the savings to be effected in reducing any one of these items will naturally depend upon the relative magnitude of the various losses in any particular case. Operating methods, composition of materials, and the type and arrangement of equipment will vary the relative importance of these items in different plants. In a well designed plant with modern equipment these losses will be somewhat as follows:

1. Heat lost in clinker	5 per cent
2. Heat lost in radiation	6 per cent
4. Latent heat of evaporation	20 per cent
5. Heat carried by waste gases	45 per cent
	76 per cent



The burning of clinker in the kilns offers opportunity for operation economies in many plants

It thus becomes evident that even in the modern plant there is considerable opportunity for improvement but it is very evident that efforts to reduce the items of the heat carried by the waste gases and the latent heat of evaporation offer the greatest possibilities of financial returns.

The losses which we have been discussing may be considered as the basic losses dependent upon present usage and may be greatly increased by superimposing upon them the operating losses caused by poor manipulation of the apparatus or incorrect proportioning of the materials handled. This loss forms a very insidious drain in those plants which do not check the fuel utilization at frequent intervals. The peculiar feature of this loss is that it may be reduced greatly without extensive alterations or large capital outlays. It is too simple a problem to be attractive to the managements of many plants who must have some complex and intricate solution to be acceptable.

The heat balance of the kiln discussed in Chapter IX shows that the various phenomena which have been observed in kiln operation may be explained in a perfectly logical manner. Four distinct processes are performed in the rotary kiln in burning the materials. Each of these processes requires a certain definite heat level for completion and can only use the heat which is available in that zone above the required level. Thus the temperature at which the heat is available will be quite important and in this way some one of these processes will limit the amount of fuel burned.

The governing quantity is the heat required for calcining the material. Thus any means for reducing the heat required in this stage will automatically reduce the total fuel required. The elimination of the water in the rear end decreases the heat required in the drying zone, in two ways. The latent heat of evaporation will not be required and the weight and specific heat of the waste gases will be reduced. The gases will thus be higher in temperature, the heat transfer will be more rapid and the weight and specific heat of the materials will be lower. This will result in quicker heating of the materials and a more efficient utilization of the comparatively low potential heat in preheating the materials before calcining. While the temperature of the exit gases will be somewhat higher, the heat carried out will be lower. Thus the elimination of the water in the slurry is probably the next logical development in the program of cost reduction.

Kiln Design

The inferences to be drawn from the discussion of the heat balance in the kiln would indicate that radical changes in the design of the kiln would be beneficial. We have several limitations with the present designs. The velocity of the gases in the burning zone will limit the economic capacity of the kiln by limiting the amount of fuel which may be burned in a given volume in a given time with perfect combustion. The temperature of the gases and the materials in the calcining zone will limit the ratio of fuel to raw materials. The velocity of the gases throughout the kiln will determine the dust loss from the kiln. The water content of the slurry will limit the fuel economy by utilizing heat in evaporating water which should go into preheating the materials for calcining.

The chapters on the thermal losses from the kilns trace the various means whereby the heat is removed from the kiln without doing useful work. The moisture which is introduced into the kiln is responsible for a large portion of these losses.

There appear to be very excellent reasons in favor of the wet process because of the chemical reactions facilitated by the colloids formed in the preparation of the materials. There does not, however, appear to be any logical reason for the introduction of this water into a piece of equipment which is essentially a furnace. On the contrary, common sense would indicate many reasons why it should not be done. A large percentage of the total heat is now absorbed in the evaporation of this water and a very small percentage of this heat may be recovered in useful form. Some efforts along this line have indicated that when the magnitude and uselessness of this loss are appreciated generally, developments toward its elimination will be rapid. To prove economically successful the water must be removed at less cost than the present fuel utilized in removing it.

The losses resulting from the incorrect adjustment of the air-fuel ratio and from the incomplete admixture of the air and fuel are more generally traceable to errors in manipulation than to faulty equipment. The ease with which these faults may be detected and corrected renders them rather inexcusable. But conditions existing in many kiln rooms would indicate that they are not recognized.

Fuel efficiency in the kiln centers around high flame temperatures and a rapid transfer of heat by radiation in the burning zone. Either an excess or a deficiency of air with the coal will result in a reduction of the flame temperature with a consequent reduction of the heat transfer which varies as the fourth power of the temperature. The luminosity of the flame and thus the relative radiation appears to be affected by the percentage of ash in the coal. As the gases come in contact only with the materials along the outer envelope, the transfer of heat by radiation has an important bearing upon the exit gas temperatures.

Coal and Its Preparation

The chapter on coal and its preparation elaborates on this theory regarding the beneficial effect of ash in the coal. There is a radical difference in the burning of coal on grates and in suspension in pulverized form. It has been generally admitted that more B. t. u.'s are required per barrel when burning with gas or oil than when burning with coal. Furthermore some of the lower grade coals use less B. t. u.'s per barrel than some of the better class coals. This point was rather thoroughly developed experimentally by the writer and the commercal results absolutely confirmed the theory. By properly safeguarding the process, in some cases, the use of a very low grade coal may thus enable a material reduction in cost without a corresponding capital outlay.

The exit gas analysis bears a very close relationship with the ratio of the fuel to the raw material and if the gas analyses are carefully taken and the analyses of the coal and the raw materials are known, we may construct curves to ascertain the ratio directly from the gas analysis. The effect of the excess air will be to modify these results. However, this effect may also be plotted on the chart, thus allowing correction for excess air.

Several types of coal were studied for their effect on the composition and volume of the gases formed. These coals varied from anthracite to lignite. With a ratio of 0.2 or 115 lbs. per bbl., the variation in the analysis of the gases from the various coals, showed that the CO_2 would vary from 41 per cent to 36.5 per cent by weight. Similarly, it is shown that the volume of the gases resulting from the burning of one barrel of clinker will occupy a volume at 1,200 deg. Fahrenheit varying from 62,000 to 80,000 cubic feet, depending on the type of coal used. Such a wide variation in the volume of the gases will give radically different gas velocities and thus different burning conditions. The charts given are intended as a guide to be followed and to illustrate the method. Such charts must be made to fit the particular conditions of the plant in question.

Recovering Exit Gas Heat

The first four chapters are devoted to the development of the process of recovery of the waste heat in the exit gases in the waste heat boiler. The successful recovery of the waste heat in the form of steam dates from the development of the modern theory of heat transfer and the development of economic means of disposing of the dust from the gases. The essential difference between the waste heat boiler and the direct fired boiler lies in the fact that in the waste heat boiler the heat transfer is mainly by convection while with the direct fired boiler it is mainly by radiation. In the application of these principles to boiler design, the arrangement of the heating surface will differ radically and the draft drop will be greater in the waste heat type. Induced draft fans are thus necessary, but the extra power for these fans will be compensated for by the additional kiln output resulting from the steady draft.

Economizers will show a higher return on waste heat boilers. The entering gases are low in temperature. Thus the gases leaving the boilers will contain a larger percentage of the total heat than with direct firing. The ratio of the gas weight to the water weight is very high. The specific heat of the gases is much higher with waste heat. Therefore it is economically possible to cool the gases to a lower temperature than is feasible with direct firing.

Superheaters may be justified on much the same grounds as economizers. They are usually installed in the more modern plants. Soot blowers, if properly installed and operated will assist materially in the efficiency of heat recovery. Where boilers are operated on the line for long intervals, evaporators are essential to provide a supply of pure boiler feed. They can also be made to absorb a large quantity of excess steam at times when the heat and load do not balance.

Flues and Gas Passages

Past tendencies have been to assume too much in the design of the flues and gas passages. Too little attention has been given to the principles underlying the design. The general impression of the flues, in the older plants especially, indicates a lack of appreciation of the operating burden thrown upon a plant by designing for high gas velocities in the flues. If the losses incident to this high velocity were evaluated against the additional cost there would be little doubt as to the designs. Our designing engineers must be brought back to a realization that plant designing is not merely drawing a few lines on paper and selecting machinery from catalogs.

The rear housings and flues should be designed to receive the hot gases from the kilns and transmit them to the boilers with a definite loss which has been balanced against the cost of construction and operation. The points to be considered for possible savings are:

1. Draft loss from flues, turns, dampers and eddies.
2. Separation and recovery of the dust in the flues.
3. Heat loss through refractories and insulation.
4. Heat loss from air infiltration and the mechanical protection of the exterior of the flues.
5. Substantial mechanical construction, provision for expansion and flexibility of the damper connections.

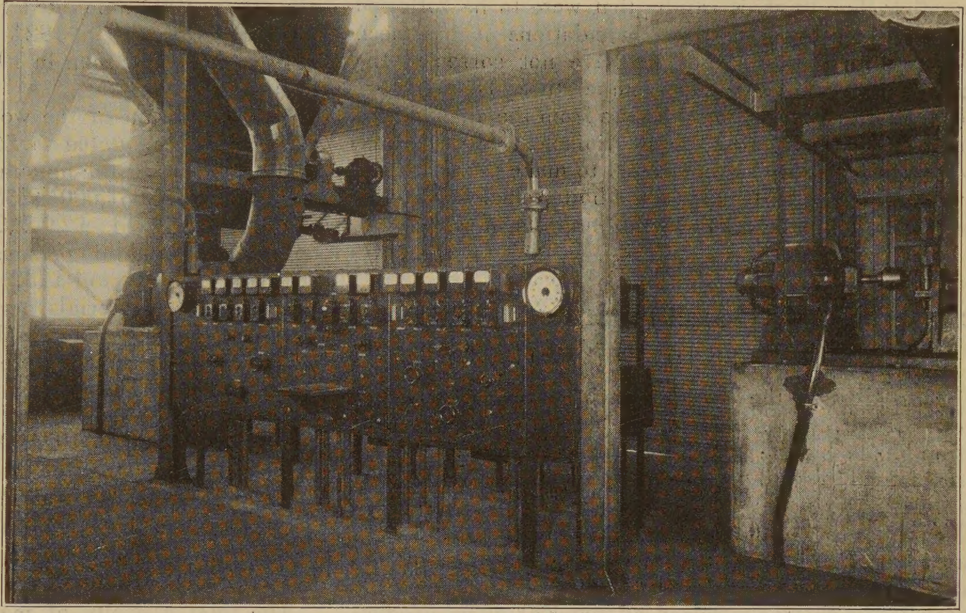
High velocity of the gases in the flues is detrimental in several ways. The necessary draft is higher, the power for producing the draft will be greater and less dust will settle out. There are several interesting relationships in this connection. Given a uniform quantity, composition, temperature and pressure, the gas velocity will vary inversely with the effective area of the gas passage. The draft necessary to produce this velocity will vary as the square of the velocity. The power consumed in moving the gas will vary as the cube of the velocity and the dust carrying capacity will vary as the fourth power of the velocity.

Many cases of high dust loss may thus be traced directly to high gas velocity. The additional annoyance and expense incident to handling the dust through the boilers and fans would indicate the advisability of the removal of the coarser particles in the gas passages. If the current gas velocities are checked against those used in the design of boiler breechings or smelter flues, the velocities are far above the economic point.

Little technical attention has been given to the settlement of the dust in the hot flues. The cost of cleaning, combined with the repairs incident to the cutting action of the dust in the flues and fans in many plants, would easily warrant the construction cost of such an installation. Dust removed at this point is readily returned to the kilns and may form from three to five per cent of the raw material.

The large areas of the flues and rear housings are susceptible to substantial heat losses from radiation and air infiltration. Very few engineers will calculate these losses. The general assumptions used are much too low. The steel encased boiler with silocel insulation replacing the outer common brick can readily be justified. As an example, assume a connecting flue 10 x 10 x 100 ft. with a gas temperature of 1400 deg. Fahrenheit and a room temperature of 80 deg. Fahrenheit. Two types of construction will be compared (A) 9 in. fire brick, 4½ in. silocel and No. 10 steel case; (B) 9 in. fire brick and 9 in. common brick. The radiation per square foot per hour will then be (A) 18 B. t.u. (B) 600 B. t.u.. On the basis of 12,000 B. t. u. coal, the annual loss will be equivalent to (A) 69 tons and (B) 864 tons. Assuming a cost of $4.00 per ton in the pulverized coal bins, the annual fuel cost for radiation will be (A) $276.00 and (B) $3,456.00. Losses due to air infiltration in the type (B) construction will usually double this amount.

A view of a kiln control board where instruments tell the burner just what is going in the kilns



These losses are insidious in that it is difficult for the executive management to form a clear mental concept of the magnitude and nature of these losses and the large financial outlay necessary to rectify errors in the original construction. Thus they go on in many plants usually considered highly efficient. They do furnish the reason, however, why some plants are not able to furnish all their power from waste heat in the kiln gases.

Instruments Indicate Operating Efficiency

The losses may be divided into two classes. Those incident to the equipment, process and materials cannot be varied much without a change in these factors. The losses due to improper operation may rise rapidly to serious proportions before being detected by the operating forces. Proper instruments and control methods should be used.

Three elements are necessary to obtain the maximum recovery of the waste heat with a minimum cost. Proper equipment, operated by a well trained organization watching operations through suitable instruments form the best combination. Excellent equipment in the hands of indifferent operators can only be expected to give inferior results. A well trained force may obtain good results without instruments but the instruments will enable them to follow results more closely than is possible without.

Unless the instruments are maintained in accurate condition and the readings used as a guide for operations they are of little use and the money had best be utilized for other purposes. Where they are used, the investment can be made to bring higher returns than is possible from a similar amount invested in production machinery.

Where the waste heat is utilized for the production of power it is necessary to coordinate operations throughout the plant more closely. This merely emphasizes a point which is really as important in either case, but is not so forcibly brought to the attention of the management where the power is separately generated. Instead of being a detriment, it is really a benefit because it calls attention to the importance of uninterrupted operation in all departments. This very interdependence of processes forces a reduction in the percentage of shutdowns.

The calculation of the heat distribution in the boilers and flues was presented to illustrate a method of calculation rather than to show results that were to be followed as a guide. In making these calculations it has been called to our attention that we have not corrected the values in the text for the room temperature. Neither have we brought out the infiltration losses from the air admitted through the leakage in the system. Sufficient data is given, however, to allow anyone interested to make the necessary calculations. This will increase the boiler efficiency appreciably and should be made in the interests of accuracy.

Census Shows British Cement Industry Progress in 20 Years

The progress of the British cement industry in twenty years is shown in a section of the census of British production made by the Board of Trade in London. This census is the first to be made since the war. The last complete census was that of 1907.

The section states that in England cement is, as a rule, manufactured at or in the near neighborhood of the quarries and other workings from which are obtained the limestone, chalk, etc., required as material in its production. The quarries are chiefly operated by the cement manufacturers, and the mineral raised is intended mainly, if not entirely, for their own use. The figures given are inclusive of the production of all quarries operated by the firms manufacturing cement in the year 1924.

The following statement furnishes particulars of the output returned for the years 1924 and 1907 by firms making returns on schedules for the cement industry. The data given for 1924 relate to works in Great Britain only, and those for 1907 to the United Kingdom as a whole. The production in Ireland in that year was not sufficient to disturb comparisons.

	1924		1907	
	Quantity Tons	Selling Value—£	Quantity Tons	Selling Value—£
Products—				
Cement for building and engineering	3,143,000	6,705,000	2,877,000	3,439,000
Chalk, prepared (including whiting)	89,000	147,000		70,000
Lime:				
White lime		46,000		19,000
Hydraulic and other lime		95,000		61,000
Casks (not included above in value of goods)		402,000		21,000
Quarry products sold		36,000		
All other products		220,000		125,000
Total value		7,651,000		3,735,000

The quantity of cement returned on schedules for other trades and requiring to be added at a later stage to the figures appearing above will probably be quite unimportant, and the output of "Prepared chalk (including whiting)" shown above is also believed to cover the bulk of the trade. Lime, however, is chiefly manufactured by other trades, and the figures now given represent only a small part of the total production during the year.

The British exports of calcareous cement in the year 1924 amounted to 651,000 tons, valued at £1,609,000 ($8,045,000), or approximately 49s. ($12.25) per ton f.o.b., and net imports to 160,000 tons, valued at £417,000 ($2,085,000) c.i.f., or an average of 52s. ($13.00) per ton. About 21 per cent of the total quantity of cement made in 1924 was exported. In 1907 the cement exported, 764,000 tons, was nearly 26½ per cent of the quantity made, and in comparing 1924 with 1907 the fact that 78,000 tons of the 1924 exports were consigned to the Irish Free State—shipments to which were not classed as exports in 1907—must be remembered. Net imports of cement in 1907 amounted to 113,000 tons. The amount available for use in 1924 in Great Britain appears to have been greater than in 1907 by something like 500,000 tons.

The net output of the works to which the above statement relates amounted to £4,679,000 ($23,395,000), that sum representing the amount by which the total value of the output, £7,651,000 ($38,255,000) exceeded the cost of materials used, £2,972,000 ($14,845,000). The net output per head of persons employed was about £363 ($1,815) in 1924 and £132 ($660) in 1907.

The cost of materials per ton of cement manufactured was 53 per cent greater in 1924 than in 1907, and products other than cement were relatively more important in the later year. The aggregate cost of materials fell from about 48 per cent of the total value of output in 1907 to about 39 per cent in 1924. In this connection it is worthy of note that, per head of the aggregate number employed, the output of cement was 194 tons in 1907 and 244 tons in 1924. The larger out-turn of cement is undoubtedly connected with a more general employment of rotary kilns.

The total capacity of machinery at the cement plants and quarries to which the foregoing statement of output relates was 90,256 horsepower in 1924, of which nearly 20 per cent was in reserve or idle. The aggregate horsepower returned for the year 1907 was 60,079. The main kinds of power employed were as follows:

Class of Machinery	1924 Horsepower	1907 Horsepower
Steam engines, reciprocating	31,540	50,874
Steam turbines	35,860	178
Internal combustion engines	22,361	8,396
Other power	495	631
Total	90,256	60,079

Electric motors aggregating 21,884 horsepower, driven by purchased electricity, were also returned for the year 1924. Of these motors about 16 per cent were in reserve or idle during the year.

The capacity of electric generators at cement works in 1924 and 1907 were as follows:

ELECTRIC GENERATORS

Driven by	1924 Kilowatts	1907 Kilowatts
Steam engines, reciprocating	10,608	5,889
Steam turbines	25,200	102
Internal combustion engines	7,767	695
Other power	125	
Total	43,700	6,685

The total horsepower of motors driven by electricity generated at the works of cement manufacturing firms was 47,875 in 1924, 10 per cent being in reserve or idle during the year.

New Volunteer Plant Near Knoxville to Be Completed in April

Construction Work on New Plant of Volunteer Portland Cement Company Near Knoxville, Tenn., Making Rapid Progress—Transportation Facilities—Raw Materials—Preliminary Description of the Plant

AT the present rate of construction now under way at the new plant of the Volunteer Portland Cement Company, it is estimated that the plant will be completed and ready for operation early in April, 1928. Weather conditions, however, may delay construction somewhat if they are unfavorable during the balance of the winter.

Considering the comparatively short time that work has been under way, considerable progress has been made, as can be seen by the accompanying illustrations. All of the foundations have been placed and many of the buildings themselves are under construction. Machinery and equipment is now being installed. The two 215-foot kilns are now being assembled in place. The two stacks, each 175 feet high, are already completed.

Location

The plant is located on a 400-acre tract of land about 6 miles east of Knoxville.

The Volunteer plant enjoys the unique advantage of both rail and water transportation. It is also as favorably located with reference to local market, water supply and raw materials as could be desired. The distance of this plant from the center of Knoxville is about five miles and it is on the Holston River.

The fact that the plant is located on a property of 400 acres, underlaid by limestone and shale, which is also adjacent to the large John Sevier terminal yard of the Southern Railway, assures it an ample supply of cars and quick service. Also large shops of the Southern system are in this district, and by reason of the constant repair work on cars and Knoxville being the center of important freight movement, it is claimed that there is always available a large surplus of leak-proof box cars. Furthermore, the Volunteer plant is within the switching limits of Knoxville and, consequently, it will enjoy through this switching advantage over the Southern Railway also the transportation facilities afforded by the Louisville and Nashville Railroad. Good roads also afford transportation to and from the plant by motor trucks.

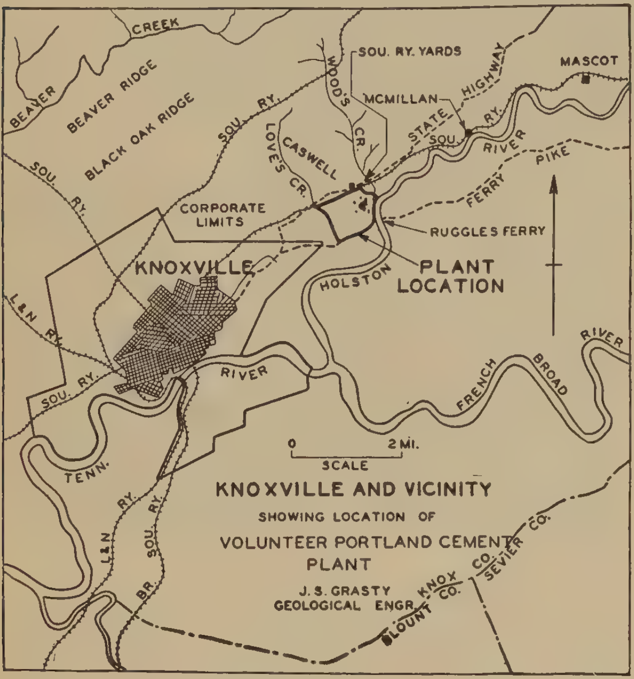
The property is bounded on the east for a mile by the Holston River and, in addition to this water supply, there are two perennial streams, tributary to the Holston, which cross it. The site of the plant is a gently rising hillside, well drained and above any possible rise of the river; and full advantage is taken of the slope of the terrain to promote the transporting of materials, and to reduce construction expense as well as to insure adequate drainage at all points.

Raw Materials

The road from the Patillo house to the Weeden house follows approximately the crest of the Patillo-Weeden Ridge and marks the general alignment of a sandy, limestone conglomerate that underlies the area occupied by shale paralleling it immediately to the south. To the north of this road occurs the Holston marble which is succeeded below and to the north by the Chickamauga limestone. The same limestone emerges on Bound's Ridge to the south, where it is in contact on the north again with the Holston marble. The Holston marble thus has been folded into a steep syncline, or trough; the area between, broadly speaking, being occupied by shale, disturbed here and there by structural dislocation. In other words, then, location is afforded for quarries, both on the north side of the Patillo-Weeden Ridge and likewise on the north side of the Bound's Ridge, the two ridges being, as stated previously, approximately parallel in a general easterly and westerly direction.

A very recent view of the new plant, showing the progress in construction and the location

The track from the quarry to the crusher passes through a gap, or saddle, of the Patillo-Weeden Ridge which is about 200 feet east of the Weeden house; this same track, traveling southward, passes over the shale area and finally reaches the Holston marble to the east of the Evans quarry. Consequently, the track just mentioned will serve both the limestone quarries and the shale quarry to be opened at some point to be determined, but probably to the southward of the Weeden house. That is to say, all the raw materials for the manufacture of portland cement are to be brought in over this same track; whereas, generally speaking, this sort of favorable juxtaposition of raw materials is rather infrequently enjoyed. The argillaceous (clayey) and calcareous ("limey") rock occurring within the limits of the property owned by the company are all of Silurian Age. Listed in the order of relative age, that is from youngest to oldest, we have the following:



KNOXVILLE AND VICINITY
SHOWING LOCATION OF
VOLUNTEER PORTLAND CEMENT PLANT
J. S. GRASTY
GEOLOGICAL ENGR.

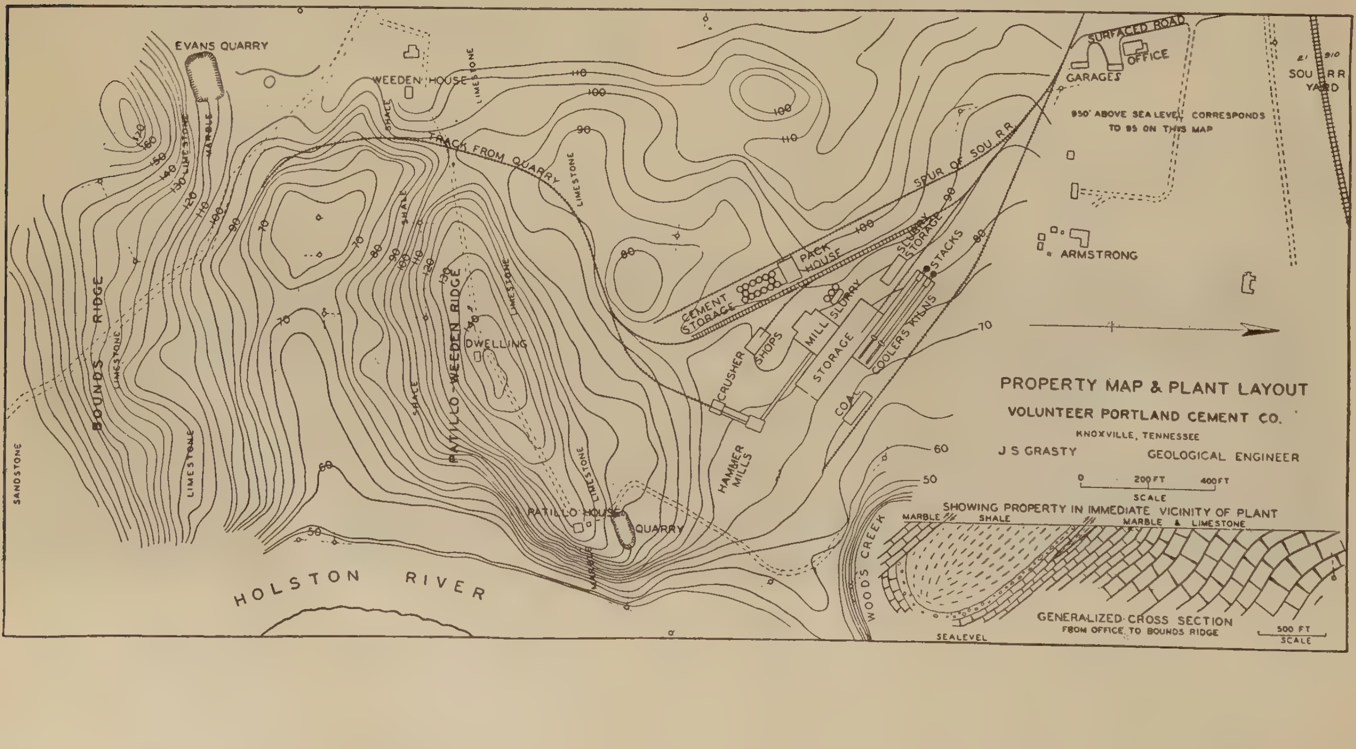
Sevier Shale, consisting of calcareous and sandy shale with thin beds of calcareous material (limestone and marble) near the base of the formation; thickness in this general area in normal section being 700 feet, more or less.

Tellico Sandstone, consisting of sandy shale and blue and gray calcareous sandstone. Thickness 100 to 350 feet.

Holston Marble. This is a crystalline member of the Chickamauga Limestone. It ranges in color from red, brown and gray to white. Thickness 200 to 400 feet.

Chickamauga Limestone. This is a thick limestone ranging in color from dove to blue and gray and in composition from limestone very low in argillaceous content, to limestone dominantly argillaceous. Thickness 500 to 700 feet.

The thicknesses as given above represent the range in thickness of these formations, as observed, to the northeast of this property. On this particular property, however, the full stratigraphic thickness of the Sevier shale is very considerably less than 700 feet; although by reason of the manner of folding an equivalent of that thickness is attained and the supply of this shale is therefore abundant. Likewise the Tellico sandstone is not represented in its full thickness though found in large quantities to the south of Bound's Ridge. However, its position in the geologic section may be considered as represented in the Patillo-Weeden Ridge by a sandy limestone conglomerate which at this point is approximately 30 feet in thickness. On the other hand, both the Holston marble and the Chickamauga limestone, which differ but slightly in chemical composition at their points of contact, and so can be quarried together, attain their usual average thickness within the limits of the company's property and, as we have seen, they are duplicated by folding. The calcareous and argillaceous material as described above occur on this property and traverse it in a direction approximately N. 60 to 70 E. in such vast quantity that, in an operating sense, they may be relied upon to last indefinitely. Both the limestone and shale are favorably situated as regards topography for operation to excellent advantage—and, as to composition, the former is much more uniform than the latter. The limestones in Patillo Ridge rise over 90 feet above water level; whereas, those on Bound's Ridge are more than 120 feet above water level. In both cases the dip is southeastward, making an angle of 55 to 60 de-



PROPERTY MAP & PLANT LAYOUT
VOLUNTEER PORTLAND CEMENT CO.
KNOXVILLE, TENNESSEE
J S GRASTY GEOLOGICAL ENGINEER

grees with the horizontal. The shale area between occupies an intermediate height which rises topographically along its strike to the westward; hence from the viewpoint of extracting both these raw materials, it is obvious that they are most favorably situated.

Analyses of Raw Materials

Analyses made on samples representing the various formations above described, of which the following are a few, are presented below:

DESCRIPTION OF SAMPLES

Sample 1, 119,702—Volunteer Portland Cement Company's property. Analysis on sample of Chickamauga limestone topographically above and adjoining south marble area, Bound's Ridge, forty stratigraphic feet (plus).

Sample 2, 110,703—Representing forty (40) stratigraphic feet of pink marble topographically below Chickamauga limestone, Bound's Ridge; Volunteer Portland Cement Company's property.

Sample 3, 119,704—Shale, extending from apple tree south of Weeden house to bottom of hollow; representative of shale lying between the two marble areas.

Sample 4, 119,705—Patillo-Weeden Ridge; representing 30 feet (plus) of knobbly, arenaceous limestone conglomerate, stratigraphically and, at this point, topographically above pink marble.

Sample 5, 119,706—Representing 200 feet of outcrop across strike, pink marble of Patillo-Weeden Ridge; Volunteer Portland Cement Company's property.

Sample 6, 119,709—Representing 20 feet in thickness of residual clay overlying Chickamauga limestone and from cut being excavated for railroad near plant site; Volunteer Portland Cement Company's property.

CERTIFICATE OF ANALYSIS

No. 119, 702-7: Samples of Limestone Shale and Clay from J. S. Grasty, letter of July 16, 1927.

Sample	Per cent 1	Per cent 2	Per cent 3	Per cent 4	Per cent 5	Per cent 6
Silica	6.08	3.73	65.47	27.16	2.80	60.44
Al_2O_3	2.13	1.92	16.34	6.19	3.24	17.57
Fe_2O_3	1.44	0.88	7.04	2.40	0.96	8.56
CaO	48.61	50.54	0.21	34.13	50.27	0.03
MgO	0.37	0.33	0.04	Trace	0.36	0.06
Loss on ignition	40.72	42.18	8.91	29.17	41.64	12.70
Manganeous oxide	-------	0.04	-------	-------	-------	-------

Analysts, PENNIMAN & BROWNE, Chemists.
Baltimore, Md.

If in the mix of raw material we use limestone No. 2—above—and shale No. 3, the resulting cement will, as worked out by Major Lewis, analyze as follows:

	Per Cent
SiO_2	20.50
Al_2O_3	6.40
Fe_2O_3	2.90
CaO	67.00
MgO	0.50

It is planned, however, to add more siliceous material either in the form of sandstone which occurs within the limits of the company's property or limestone No. 4 may be employed as a partial corrective for high lime content of the cement.

Trenches have been opened at right angles to the strike of the marble, limestone and shale formations. The purpose is to expose and then in suitable divisions to provide samples across the entire width of the formations so that the structural relations of the formations may be worked out in greater detail.

Recent analyses of marble, limestone and shale have given results as tabulated below. From 20 consecutive analyses of marble the average results are as follows:

	Per Cent
SiO_2	0.4
Al_2O_3	0.35
Fe_2O_3	0.19
CaO	55.056
MgO	Trace
V. M.	42.865

These samples number 1-B, 1-C, 1-D and the rest were on line A from 39 to 44 and from 66 to 77.

Since limestone can contain only 56 per cent calcium oxide, no further comment need be made as to the high degree of purity of this limestone. For cement manufacture, it would be better if it were not so very high grade yet it may be used to advantage when siliceous (sandy) and argillaceous rock—both occurring in abundant quantity, are added to compose the "mix."

Seventy-two consecutive analyses of shale gave average results as follows:

Installing the kilns. There will be two 215-foot rotary kilns

	Per Cent
SiO_2	58.9
Al_2O_3	20.4
Fe_2O_3	9.4
CaO	0.3
MgO	1.9
V. M.	7.9

These shale samples were numbered 16-A to 34-A; 2B to 24B; 20 to 22C, and 2D to 14D. Commenting on the foregoing, Major Lewis says: "I find it entirely practical to make an excellent cement from shale and limestone of compositions stated above. Analysis of the cement as shipped from the works would be about as follows":

	Per Cent
SiO_2	20.00
Al_2O_3	7.25
Fe_2O_3	3.40
CaO	65.00
MgO	0.60

The raw materials—limestone, marble, sandstone and shale—have been examined and their suitability to manufacture a high grade of cement has been passed upon favorably by no less an authority than Edwin C. Eckel, mining and economic geologist, author of "Cements, Limes and Plasters," and widely known as a specialist on matters relating to portland and other types of cement. All these materials are easy of access from the plant; any desired combination can be had both cheaply and accurately but, as has been emphasized in this article, a suitable plant to meet present day demands to produce a portland cement which will develop strength and hardness quickly is equally important; and the Volunteer company has such a plant in process of construction which will employ the raw materials as described above.

Quality of Cement

The Volunteer brand of cement, without making any "super" claims or any invidious comparisons, which the officers of the company would be very prompt to disclaim, will comply with as rigid specifications as modern practice may properly demand. In brief, this Knoxville plant—using the wet process—is so designed that its manufactured product shall approach, as nearly as may be by the modern practice, the "latent possibilities of the portland cement formula."

As to how to accomplish this to best advantage, is the problem of Major F. H. Lewis, consulting engineer, under whose direction the new plant is now being constructed. As to the question of recent investigations into the properties and possibilities in cements and their manufacture to accomplish certain definite results, as well as the new conditions to which the portland cement industry must adapt itself with respect to its product, Major Lewis says:

"No manufactured article in the world has been, in recent years, so intensively studied and experimented with as portland cement. There has been a persistent demand that this product should be so manufactured and so manipulated in making concrete as to realize maximum results in a minimum of time.

"Concrete was formerly a material for foundations, for sidewalks, for curbstones, and for such relatively minor purposes. It now constitutes the entire structural framework of great buildings and bridges. And in order that it may be used for such major purposes, it evidently must be strong, and it must develop strength and hardness quickly, so that construction work may progress continuously and that the cost of form work may be kept within reasonable limits.

"Long series of laboratory tests have shown conclusively that the regular grade of portland cement turned out by the factories, while it is sound and reasonably strong, does not begin to develop the full latent possibilities of the portland cement formula. These demonstrations have placed it fairly up to the cement manufacturers to improve their methods so as to turn out regularly a superior grade of portland cement at moderate manufacturing cost.

"As a general formula this means that the composition delivered to the kilns shall always closely approach the theoretical chemical formula and shall be very finely ground. The finished product will then necessarily be close to the theoretical formula, and the cement must be finely ground. The mixing facilities for the continuous accurate blending of the raw material must be accurate and extensive, and the grinding machinery must be the best."

Plant Equipment

The plant will employ the wet process of manufacture and will be electrified throughout with power furnished by the Knoxville Power and Light Company through a well equipped sub-station located on the property; the management expects to use local labor, products and supply materials to the greatest possible extent.

Machinery and other contracts were awarded as follows:

One 36-inch Superior gyratory crusher—Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Diesel drag line and electric shovel—The Bucyrus Company, South Milwaukee, Wis.

Two 175-foot concrete kiln stacks, one 12-inch bin stock house, slurry basins and 4-story bag and packing house—Burrell Engineering and Construction Company, Chicago.

First section of railroad siding, plant tracks, excavation for pack and stock houses and roadway into plant site—Dempster Construction Company, Knoxville, Tenn.

Water pump—Dravo-Doyle Company, Philadelphia.

Ten steel quarry cars—Easton Car and Construction Company, Easton, Pa.

Conveying System—The Fuller Company, Catasauqua, Pa.

Coal drying, pulverizing and transport equipment—Fuller-Lehigh Company, Fullerton, Pa.

Motor switches, transformers, etc.—General Electric Company, Schenectady, N. Y.

Four thousand cubic yards of gravel and 2000 cubic yards of sand—Knoxville Sandgravl Material Company, Knoxville, Tenn.

Three buildings—Ingalls Iron Works, Inc., Birmingham, Ala.

Air compressors—Ingersoll-Rand Company, New York.

Garage, laboratory building, shop piers, clinker storage, concrete for buildings—A. R. McMurray Contracting Company, Louisville.

Building and machinery foundations—McMurray Construction Company, Knoxville, Tenn.

Two hammer mills and feeds—Pennsylvania Crusher Company, Philadelphia.

Four Unidan mills, machinery and structural steel, parts for 3 correcting basins for slurry, 1 quadruple mix basin for slurry, and one slurry—F. L. Smidth & Co., New York.

Eight poidometers—Schaffer Poidometer Company, Pittsburgh, Pa.

Two rotary coolers—Traylor Engineering and Manufacturing Company, Allentown, Pa.

Machine shop building—Virginia Bridge and Iron Company, Roanoke, Va.

Two 215-foot rotary kilns—Vulcan Iron Works,, Wilkes-Barre, Pa.

Locomotive—George D. Whitcomb Company, Rochelle, Ill.

Cars—Southern Equipment Company, Memphis, Tenn.

Well drills—Armstrong Manufacturing Company, Waterloo, Iowa.

Bridge crane—Milwaukee Electric Crane and Manufacturing Company, Milwaukee, Wis.

Dust collecting machinery—Northern Blower Company, Cleveland, Ohio.

Slurry pumps—A. R. Wilfley & Sons, Denver, Colo.

Torpedo conveyors, clinker cooler equipment, including inlet hoods, grinding chamber, spraying buckets and cooler bearings, with automatic oil lubricating system—American Miag Corporation, Buffalo, N. Y.

Personnel

The company is headed by J. Ross Hanahan, president, one of the pioneer portland cement men of the South. With Major Lewis and others, he was interested in the plant at Leeds, Ala., which they built and, after successful operation, sold to the Atlas company. He is thoroughly familiar with southern markets and problems and understands that section's financial and industrial needs, particularly as applicable to the territory his company is to serve. In Knoxville Mr. Hanahan will have the active co-operation of J. Howell Davis, as vice-president, who has been prominently connected with important and successful enterprises in that section of Tennessee, of which Knoxville is the industrial center. The secretary and treasurer of the company is E. Earl Evans, formerly treasurer of Commissioners of Public Works (Water Department), and also lately Comptroller of the City of Charleston, S. C.

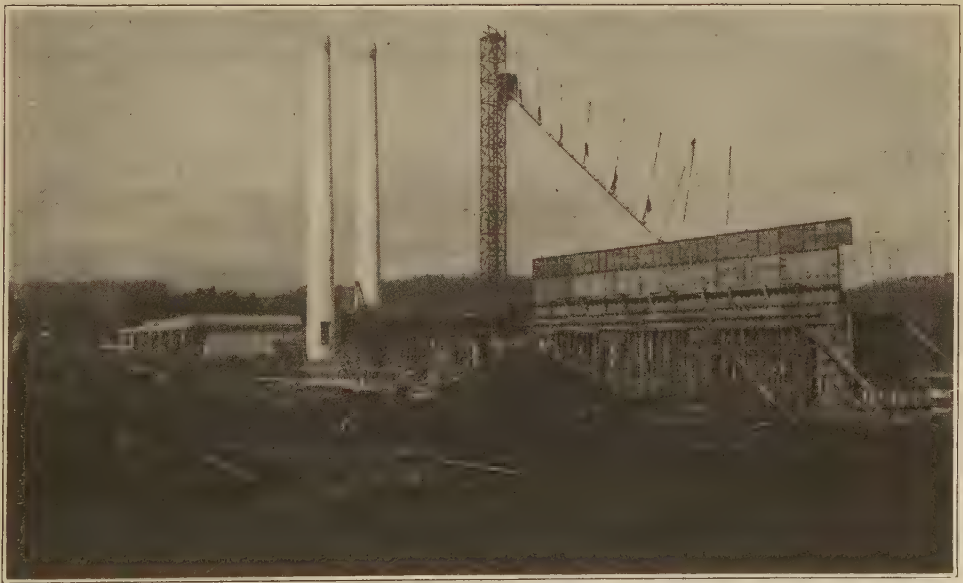
Charles F. Lewis, manager of the company, was "raised up," so to speak, in the atmosphere of portland cement plants. From his early youth his contact with the industry was interrupted only during nine months of each year while taking his degree at the University of Pennsylvania. Then once more the continuity was broken by the World War, when he rose to the rank of major of engineers, attaining the same rank as his distinguished father. After the war, Mr. Lewis resumed his connection with the Standard Portland Cement Company at Leeds, Ala., as superintendent, and when that company was sold to the Atlas company, he remained there as plant manager and later became assistant general superintendent of the Atlas. He resigned in May, 1927, to come to the Volunteer company at Knoxville.

Another construction view showing the use of slip forms

The plant was designed, and is being built under the direction of Major Frederick H. Lewis.

We are indebted to the "Manufacturers Record" for certain portions of this article taken from a description written by J. S. Grasty, geological engineer. The two location maps on Page 108 are reprinted with their permission.

A view showing the plant in the background



The two stacks of reinforced concrete, each 175 feet high, are already completed

The Screw Conveyor and the Food Chopper

By JACK DEMPSTER
Canada Cement Company, Ltd., Port Colbourne, Ont.

THE screw conveyor is one of the major mechanical hazards in cement plants. The features that make it a valuable part of cement plant equipment also make it dangerous.

The object of this article is to bring the dangers of the screw conveyor before the workmen in a forcible manner, using an illustration with which every cement worker is familiar. Safety men in cement plants are asked to use the material in this article in any way they see fit.

IT is to be found in practically every household, this homely-looking little machine. Not much to it, is there? But, fastened on your kitchen table, this little food-chopper, or meat grinder, as some folks prefer to call it, performs an important part in preparing many tasty dishes to tempt your appetite. It does not seem so long ago that we used to watch the housewives making sausages with this machine, and, with the era of artificial teeth, many an old-timer has to have his meat passed through the little chopper.

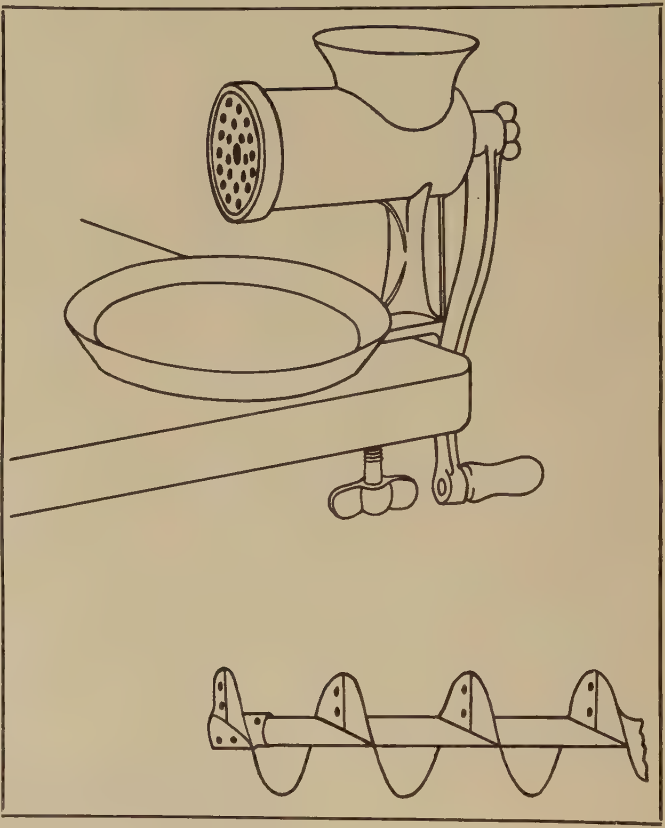
Have you watched your wife or mother grinding meat in this device? You know, she cuts it in pieces of about 1½ inches square and puts it in the hopper at the top, pushing it in well and turning the crank the while she is doing so. You can hear it now—crunch, squish, squosh, and from the front end comes a mass of tiny particles of sticky meat and fat, just like the inside of a raw sausage. If, by chance, a small piece of bone was put in with the meat, it made no difference, it was ground up just the same, crunch, crush, and some people even use their choppers to grind up small bones for their chickens.

When you were a little boy, do you remember how, while you were watching so intently as your mother turned the handle, you loved to give the crank a twist yourself. You remember how mother warned you so carefully against getting your fingers in the top of the hopper with the meat! She told you that if you got your hand in there while the crank was being turned, your little fingers would be cut off and ground up, oh, so easily, just as easily as the meat she was using. Ever after, you showed respect for that meat grinder; you knew what it would do if you were not careful, and you never let it get a chance.

Do you know what the inside of this grinder, that is, the moving part, looks like? Of course you do! A screw conveyor! And there are many of them in use all over this plant, moving the raw materials and cement from one place to another.

The only difference there is between this screw conveyor and the old meat-chopper you have at home, is that your chopper is turned by hand and can be stopped instantly by yourself, but, the screw conveyor has a powerful electric motor turning it, and it doesn't stop for small things such as a piece of meat, but goes on and on. It is intended to convey, only, but a man's leg, his arm, his whole body even, can be drawn into this screw and ground up, *and has been ground up*, exactly the same as your food-chopper grinds the smaller pieces of meat.

These screw conveyors are covered, for your protection, yet men remove the covers and, forgetting, step or fall into a horrible mutilation. You remember the accounts of death and mutilation caused by screw conveyor, we published in the last week's list of "Significant Accidents"! They were not in our plant but some of them should make us sit up and take notice. We have had some mighty narrow escapes on Plant 8 from this same cause and some men are working with us today and walking around all right, who have every reason to be thankful that Providence, who watches over man, snatched them from those powerful, twisting, grinding screws in time.



The meat-chopper and the screw-conveyor, they are both the same thing, and sometimes, oh, so unfortunately, they do the same work—grind meat, only the one grinds dead beef for your dinner and the other grinds the flesh and bone of a living human being.

Watch those conveyors; take no chances with them; do not leave them uncovered, for no more fiendish, hellish instrument of torture and death has ever been invented.

Speed Reducer Types

A Discussion of Several Types of Speed Reducers, Their Design, Capacities and Suitability for Various Industrial Uses

By C. G. WENNERSTROM

A SPEED reducer may be defined as an assembly of gears within an enclosed housing, the purpose of which is to secure a desired reduction of speed between a driving and a driven shaft efficiently, within a minimum space. The purpose of the enclosed housing is to retain the lubricant for moving parts and protect them from disintegrating abrasive external effects, also to protect operatives from danger of moving parts.

The great variation of requirements on speed reduction units has resulted in the design of a number of different types. It is true that in many cases a speed reducer of one design can be substituted for a reducer of some other design without alterations or modifications, but in many cases, some one type will more nearly fulfill the specific requirements than any other type.

Successful speed reducers of different types are produced by a number of different manufacturers and it can be said that the matter of theoretical design, while an important factor, will not alone insure a machine successful in practical operation. Theoretical design must be supplemented by careful investigation and analysis of each minute detail of the construction and the proper proportioning of the various parts not only for strength, but for ultimate wear under the severe operation conditions the unit may be called upon to meet.

Types of Speed Reducers

In this article we will endeavor in a general way, to touch on the different types of speed reducers most suitable and economical for various kinds of industrial service. We will begin by grouping the common types into three classes, basing the classification on the type of gears used rather than on the general construction of the different units.

These three general types are: first, the spur gear speed reducer; second, the herringbone gear reducer; third, the worm gear speed reducer.

We will, in the following discussion, follow the order in which these designs have been developed and adapted for their particular use in industrial service.

Spur Gear Speed Reducers

These units are called spur gear reducers from the fact that combinations of spur gears are used to produce the desired speed reduction. This type is usually of the straight line drive variety meaning that the high and slow speed shafts are concentric. They are fully enclosed and self-lubricating.

Much has been said and written to bring out points in favor of the different gear combinations such as the non-planetary, planetary, and the multiple back gear type, and as these arguments have been published in a number of industrial periodicals during recent years, we take it for granted that the reader has a general idea of the different construction principles so it will be of little interest to review these different points in the present article.

Figure 1 illustrates the general construction of a spur gear reduction unit. The pinion instead of meshing directly with a slow speed gear transmits its power through a number of idle gears to a large rotating internal gear. This arrangement is repeated for each individual reduction step. This construction has the advantage of producing a small and compact unit with comparatively small gears and as the pinion is located concentric with the slow speed gears the bearing pressures on the high and slow speed shafts are to a certain degree balanced. This does not mean that there are no bearing loads in a spur gear reduction unit of this type. However, as the bearing load is distributed among the idler gears and as these are well oiled and protected, frictional losses and maintenance costs are comparatively low.

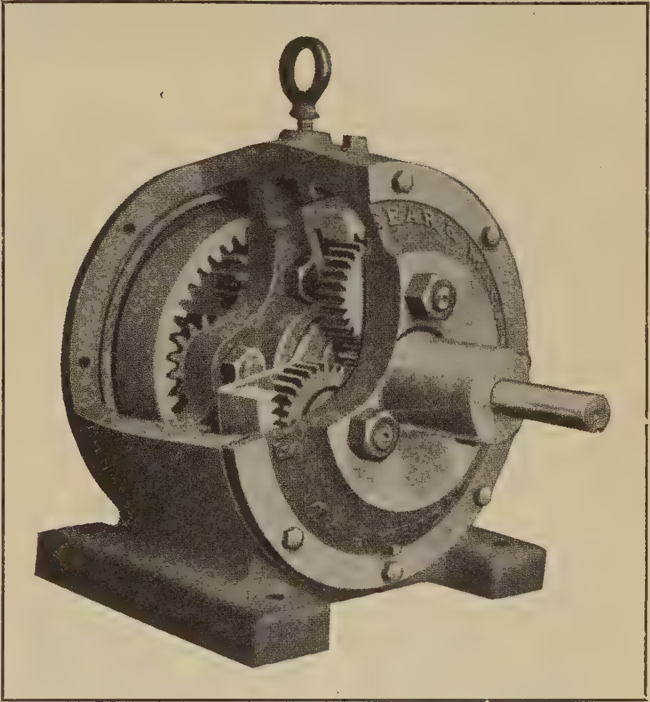


Figure 1

When hardened and heat-treated gears are used in spur gear reducers of this type, the power transmitting capacity is generally about the same as that of an electric motor of the same rating to which it may be connected, although the torque ratio of the high and low speed shafts, will run very high in most cases. This is a greater advantage when space is valuable and a combination of an electric motor with a reducer of this kind makes a neat and efficient installation wherever shafts are to be direct connected in line by flexible couplings. The construction is somewhat at a disadvantage in the case of an overhung load on the extended shafts. This tends to produce excessive leverage, considerable heating and rapid wear. This disadvantage, however, is readily overcome by the use of an outboard bearing where side-pulls are encountered, as in the case where a pulley, gear or sprocket is mounted on the extended shaft.

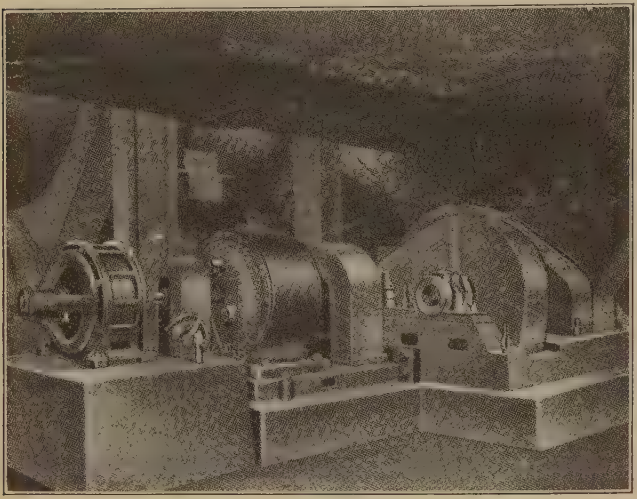


Figure 2

The speed at which spur gear reducers are operated should not exceed speeds recommended by the manufacturers, as the types of gears, and the combination of the gears used, do not lend themselves to speeds above ordinary electric motor speeds. For sizes of 25 H. P. or more, moderate speed motors are preferable. High speeds will produce excessive heating and in many instances undesirable noise and vibration.

Herringbone Gear Speed Reducers

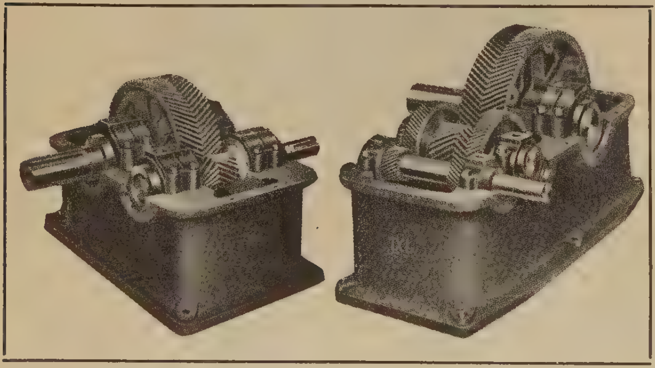


Figure 3 *Figure* 4

Herringbone gears were primarily developed in order to obtain a smooth and continuous tooth contact, and to give a silent, vibrationless transfer of power from one gear to another. This, of course, holds true for single helical gears, the only object of double helical or herringbone gears being to eliminate end-thrust.

With modern gear-cutting equipment, this type of gearing has attained a high degree of perfection, and it is used to advantage in connection with reduction of very high speeds such as are encountered in the operation of steam turbines, certain kinds of water wheels and high speed electric motors. Herringbone gears are also to be recommended where production processes depend on smooth operation of the production machinery.

Herringbone gear speed reducers are the natural result of the application of herringbone gears with their many advantages to the enclosed type of reduction unit.

Figures 3 and 4 illustrate the compactness, simplicity and sturdiness of this type. These units can be used on lower reduction ratios for increasing speed, but wherever used for this kind of service, precaution should be taken both as to the design of gears and to the system of lubrication. The full details of service required should be given the manufacturer.

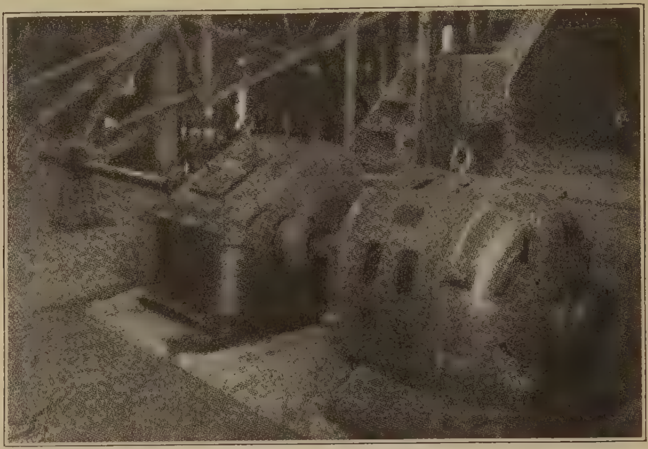


Figure 5

The overall dimensions of the gears and housings of herringbone gear reducers are somewhat in excess of the dimensions of spur gear reducers both of the same power transmitting capacity. This is due to the high speed and slow speed shafts of the herringbone type running parallel and because the pinion and gear are only engaged at one point as compared to several points in contact with the spur gear type. However, by proportioning the sizes of the gears in reduction units of more than one gear train to suit the torque, it is possible to use smaller gears and finer pitches on the high speed end and thus minimize the overall dimensions of the housing. High ratios are available in small housings by compounding and tripling the reductions.

Figures 5 and 6 show two typical installations of this type of reduction unit. Briefly, the advantages of a herringbone gear reducer as compared to the spur gear reducer are as follows:

1. It will handle high initial speeds.
2. It will stand shock loads better on account of its tooth construction.

Figure 6

3. It will give a smoother transfer of power from one gear to another.
4. It can be used for speed increasing purposes at lower reduction ratios.

5. Generally a herringbone gear reducer will carry a certain amount of overhung load on the extended shafts without the addition of an outboard bearing, but this load should not be greater than recommended by the manufacturers.

Worm Gear Speed Reducers

Worm gear speed reducers and their principles of operation have been known for a long time, but it was not until recently that this type of reducer has received the kind of attention that brings about constructive development. The worm gear type of reducer has been and is still considered by many as a very inefficient and unreliable means of speed reduction, but recent investigations have brought about improvements in design and manufacturing methods that have resulted in the development of distinctly modern and effective worm gear reducers to meet the exacting conditions of modern industrial service.

These developments have brought the modern worm gear reducer into a class of high speed, high efficiency and high power transmitting capacity but the simple compact construction is retained and makes it an ideal drive where space is limited and where the power has to be transmitted at right angles. The efficiency of this type is almost on a par with any other type of reduction unit and at certain low ratios, the efficiency is even greater than the spur type and bevel gear reducers. Due to the simplicity of design and its adaptation to any kind of position and installation, the high efficiency worm gear reducer has found a wide popularity.

Worm gear combinations in suitable housings will run in any position, vertical, as well as horizontal.

From an economical standpoint, worm gear reducers can be divided into two groups. One group is the original development usually equipped with commercially cut worm gears and worms made from some fairly high carbon steel and keyed to a worm gear shaft. Bearings are usually plain sleeve bearings depending on lubrication from the splash of the worm and worm gear.

Illustrations 7 and 8 give a good view of the general construction of this type of worm gear reducer. Although, perhaps, it appears to be an antiquated type of equipment, it has nevertheless a wide application as a cheap and dependable unit with higher reductions in intermittent and temporary service where the power transmitting efficiency is of no importance. It gives good results on the slow speed end of extremely high reduction, and is a useful timing device as a combination of a few worm gear ratios would give very high reduction with comparatively few parts. It is indispensable on many hoists and elevators on account of self-locking properties on high ratios.

The public is often confused as to the self-locking ability of worm gears. Several conditions influence this feature, the main one being the lead angle of the worm thread. On a plain bearing worm gear reducer, it is safe to assume self-locking when this angle is six degrees or less. This angle will give about 50 per cent efficiency and in order for a worm gear to lock, the efficiency must be 50 per cent less.

The second group is the new development as previously mentioned.

In this type all unnecessary friction is eliminated in the shaft bearings by incorporating ball and roller bearings to take care of radial and thrust loads on the worm and worm gears. Thus the efficiency of these units is exceptionally high.

Great care is necessary in the tooth design and specially designed manufacturing tools and equipment are necessary to insure extreme accuracy in the production of worm gears and other parts.

Maximum results are only secured through the use of highest grade materials carefully selected. This together with close attention to manufacturing processes, insures perfect tooth contact and extreme quietness in operation without vibration.

Uses and Applications

As the worm gear reducer delivers power only at right angles, it is not suitable when driving and driven shafts must be parallel or concentric. There are, however, many uses for which the worm gear reducer is better adapted than any other type of speed reducer.

Because of their almost noiseless operations, they are ideal for driving fans which have a tendency to transmit all sounds that originate nearby. They are very successful as right angle drives in large process machines, where unusual smoothness of power flow is required. The horizontal type are also used as right angle reduction drives with electric motors and gasoline and oil engines—often with the slow speed shaft extended on both sides for a double sprocket or gear drive.

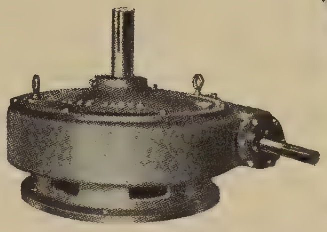


Figure 7

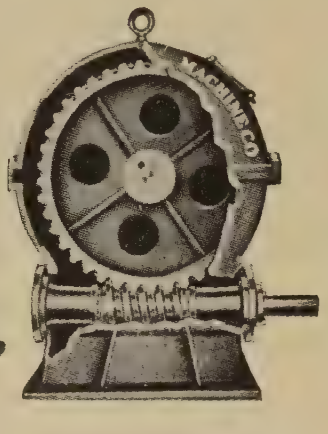


Figure 8

They seem to be particularly well adapted for use with high speed steam turbines and are being successfully operated at speeds up to 4,000 or 6,000 r.p.m. on the worm without undue heating.

The vertical type of the worm reducer delivers power either upward or downward, or in both directions when desired, through its vertical slow speed shaft. Because of the angular drive, this type driven by a standard horizontal motor makes an ideal combination for driving agitators, mixing and stirring machines, vertical, submerged centrifugal pumps, capstan drives and other machinery operated by vertical drive shafts.

Preparations for Leipzig Trade Fair Under Way

Plans are being made for more than 200,000 visitors and 10,000 exhibits at the annual Leipzig spring fair to be held from March 4th to March 10th, at Leipzig, Germany.

The Leipzig fair has tripled in size and attendance since the war. The group of 100 special exhibition building which housed the fair will be increased this year and many new features introduced. A new hall, twice the size of the Madison Square Garden in New York, has also been built. The fair will include 1,200 exhibits of technical machinery.

The enterprise is represented in America by the Leipzig Trade Fair, Inc., 630 Fifth Avenue, New York City.

Coal Stocks Returning to Normalcy According to Survey

A decrease of slightly over a million tons of bituminous coal stocks in industries in the United States took place from October 1st to November 1st, caused largely by the fact that although the consuming public realized that it was no longer necessary to maintain stocks on account of the strike conditions, it had coal commitments which more or less sustained shipments up to the first of November. The reduction in stocks necessary to bring the country to a normal basis as advised last month in the amount of around 10 million tons was still to be accomplished after November 1st and the depletion in production during the month of November shows that this is now being undertaken, according to figures provided by the National Association of Purchasing Agents.

With business conditions about the same, total bituminous coal requirements from mines in the United States for the month of November should be about 45 million tons and for the month of December, 48 million tons, making a total of 93 million tons required, deducting 10 million tons for depletion in stocks, which makes total requirements of 83 million tons.

There was produced during November, up to November 19th inclusive, approximately 28 million tons, making a total requirement from November 19th to January 1st of 55 million tons. Thus the average requirement for bituminous coal during this remaining period to January 1st should not be more than 9½ million tons per week if stocks are depleted.

Coal in storage as of November 1st including anthracite and bituminous in the United States and Canada in industries amounted to 58,600,000 tons. Consumption during the month of October was 35,800,000 tons, retailers consumption in stocks running about normal. Industrial stocks in the United States and Canada constituted an average supply of 46 days as compared with 34 days a year ago.

Output of by-product coke during the month of October amounted to 3,713,000 net tons, a slight increase from the preceding month, but the rate per working day was slightly lower than September.

Production of Beehive coke during October amounted to 2,784,000 gross tons or practically a 3 per cent reduction per day as compared with the preceding month. Coke production has been running under last year in line with the output of pig iron which for the first 10 months of 1927 was 5½ per cent lower than the same period for 1926.

All of these stocks are exceedingly high as compared with November 1, 1926.

In Illinois and Indiana operations have been reduced as low as one to two days a week and if the mild weather continues there will be additional mines closing. Pocahontas coal around the Chicago district is being sold at a very low price. The new Illinois machine loading agreement has been put into effect by the new board established by the recent agreement between the operators and miners in this district. This agreement allows the operators the privilege of installing equipment as they see fit. The wages and conditions upon same remaining as heretofore.

In Colorado the governor issued a proclamation placing all the mining districts in the state under martial law and sent troops to the northern fields, and no doubt, if there is any further picketing in the southern fields troops will be sent there also. The situation has been steadily improving in the last two weeks and the calling of the troops should allow miners who desire to return to work and consequently means that the situation will improve from now on.

Prices in the east are very soft although operations are getting down on a more steady basis.

Ohio and Pennsylvania operators are still strongly endeavoring to go non-union and are making some progress.

COMPARATIVE ESTIMATES OF U. S. PRODUCTION AND CONSUMPTION, AND STOCKS OF ANTHRACITE AND BITUMINOUS COAL IN INDUSTRIES OF THE UNITED STATES AND CANADA

	United States Production	Industrial Consumption	On Hand in Industries
May	44,475,000	37,817,000	72,288,000
June	41,999,000	36,690,000	66,510,000
July	38,597,000	33,560,000	62,585,000
August	48,907,000	33,900,000	59,697,000
September	48,592,000	33,195,000	59,179,000
October	51,400,000	35,813,000	60,154,000
November 1	—	—	58,602,000

Adoption of Metric Weights and Measures Urged

The Pan-Pacific Standardization Conference met recently in San Francisco to further the adoption of the decimal metric weights and measures in the United States. A series of round-table discussions were held, at which reports were presented from Japan, Australia, Mexico and South America, indicating a world-wide trend to metric units.

"It is manifest that the future trade of the Pacific is to be largely upon the metric basis," declared Calvert E. Hydes at the final session, "and it is urgent that the United States shall unify its commerce on these unvarying standards likewise. Already the Philippines, Japan, Siberia, Indo-China, the Dutch Indies, Siam, French Oceania, Mexico, the Central American Republics, Colombia, Ecuador, Bolivia, Peru and Chile are among the Pacific countries on the metric basis. The Orient has definitely decided upon metric units, and has rejected the so-called English units. China, for instance, is making rapid progress in adoption of the metric standards."

Endorsement was given to the Britten-Ladd Metric Standards Bill, introduced in the new Congress, providing for gradual establishment of metric measures in merchandising throughout the United States.

A statement by Hon. Frederick H. Gillett, senator from Massachusetts, was read at the conference. "In our world commerce the advantage which metric units will give to our industries is manifest," Senator Gillett declared. "The advantage of having these units decimally divided is so obviously illustrated by our experience with the American dollar that it does not require argument. All sorts of calculations will be greatly facilitated. Objections to the metric system are in the main voiced by those representing vested interests."

It was stated by speakers at the standardization conference that all civilized nations except the United States and the British Commonwealths are now using metric weights and measures, and that British units are largely different from those used in the United States. Metric standardization, it was prophesied, soon will be complete.

Cotton Bags Specified by Highway Commissions

That cement be packed in cotton bags of American manufacture is a new stipulation that the South Carolina Highway Commission now requires in contracts.

The highway commissions of Alabama, Florida, Georgia, North Carolina, and Virginia have for some time been specifying that all cement shipped be packed in cotton bags. This action was taken to promote the use of cotton.

EDITORIALS

Cement in Nineteen Twenty-Eight

AGAIN, in 1927, the cement industry writes down to its credit an increase in the shipments of portland cement in the United States.

This, in the face of a construction year that has shown very little, if any, increase in the volume of construction undertaken over the previous year, is a record very much to the credit of the industry.

Some authorities estimate that great increases in the uses of cement cannot be expected in the future —that cement shipments have become fairly well stabilized at or near their present level. It is not reasonable to expect phenomenal increases in construction volume during the years immediately ahead. Some advance may be made in proportion as population increases, but this will not be great. Increases in the sales of cement, therefore, must depend upon this slower increase in demand and upon such additional business as may be developed by the substitution of concrete for other building materials.

It has been pointed out that the shipments of portland cement during the past year have been only about three-fourths of the rated capacity of the cement plants in operation during 1927. Eight additional plants, now under construction, will come into operation during the next season. In addition, there are at least eighteen plants now being more or less actively promoted. It is significant that five of the eight plants now under construction are being built by companies already in the business of producing cement. The others are companies that have no other interests and in many cases are headed by men previously in the cement industry.

A comparison of sales prices made by an authority in which a "true" or relative price of cement is figured on the sales prices of other building materials, shows an almost uniform reduction of true price during the years 1924, 1925, and 1926. Computed on this basis, the true price of bulk cement at the mill was only 98.6 cents per barrel in 1926 as against $1.14 in 1921. Foreign competition and internal competition have operated to bring this true price still lower during the past year.

In common with practically all other industries, the cement industry must face this condition of small unit profits. Like all other industries, also, it must concentrate even more keenly than before on problems of manufacturing and sales cost reduction in an effort to once more widen the gap between cost and sales price. The coming years will be a period of management problems.

That the industry has been exerting efforts to reduce manufacturing costs by the installation of new, better equipment is eloquently illustrated by a report released on November 15th by the U. S. Bureau of the Census listing the increase in machinery used by various industries from 1923 to 1925. The increase in cement-making machinery during that period was 50.34 per cent, while that for industry in general is roughly estimated by one organization as only 7.5 per cent.

Yet there may still be opportunities for reducing manufacturing costs through the installation of more efficient machinery and by operating existing equipment more economically.

There has been a definite indication of improvement in the quality of cement, especially during the past year. Changes or modifications in the demands of users are being met, in a measure at least.

Though most of the cement being marketed is still sold as a standard product, there are indications that some manufacturers have considered the special requirements of some users of cement and have given them a product incorporating the special qualities they demand.

How far this diversification in qualities of cement will develop is of vital concern to the industry. The solution of the problem will undoubtedly be found in the field of the ***uses*** of cement, and in the performance records of structures in which the new cements are being used.

In the field of the uses of cement, also, there is a definite trend toward better control in the making of concrete. This is of the most vital interest to the cement manufacturer because it is the important development affecting every phase of cement manufacturing and marketing. Just as there are evidences of real progress in the ***manufacture*** of cement, so there are in its ***uses,*** each of which reacts on the other and both of which must embrace the interest of the cement manufacturer.

MEN and MILLS

Notes from the Field

Propose New Plant in Seattle

Subsidiary of Pacific Coast Company to Build Two-Kiln Plant—Will Have 500 Feet Water Frontage—Wet Process Will Be Used—Limestone Via Water from Island 600 Miles Distant

A NEW cement plant project for Seattle, involving an expenditure of upward of $4,000,000, is announced by Walter P. Barnum, president of the Pacific Coast Company, of which the newly formed Pacific Coast Cement Company will be an added subsidiary.

Plans of the company include construction, to begin soon after the first of the year, of a two-kiln plant on a 19-acre tract within the corporate limits of Seattle and with 560 feet frontage on tidewater.

The plant will be constructed to produce 1,000,000 barrels of cement annually, with provision for future expansion of the units and plant additions to take care of increased requirements up to 3,000,000 barrels annually.

The limestone, which forms the basic raw material, will be brought by water from Dall island, which lies about 65 miles west of Ketchikan, Alaska. The distance of the water haul is 600 miles.

In connection with transportation of the limestone the Pacific Coast Cement Company has signed a firm contract with the Pacific Coast Steamship Company for the movement of the limestone from tidewater at Dall Island to the Seattle plant at a cost of less than $1.00 a ton. The latter firm is another subsidiary of the Pacific Coast Company but inactive since 1916, when it disposed of $3,000,000 worth of ships and equipment to Pacific Northwest shipping interests.

The Pacific Coast Steamship Company will purchase from the United States Shipping Board two steamships with coal burning equipment and having 6300 deadweight tons capacity. Negotiations are now nearly completed for purchase of the vessels and rock will begin moving from the quarries on Dall Island to the pile at the Seattle plant location by the middle of next summer. A supply will be accumulated in advance of the beginning of operations by the plant.

The projected cement plant will be the first in the Pacific Northwest to bring its raw materials over as great a distance as 600 miles and the first to place a plant in the center of its distributing area.

Contracts have been signed for other materials necessary to production. The fuel for the new plant will be supplied by the mines of the Pacific Coast Coal Company, also a subsidiary of the Pacific Coast company. The fuel will be of a grade difficult to dispose of in this territory because of low commercial value. The haul from mine to the plant will be approximately 15 miles.

The limestone will be crushed at the quarry on Dall Island to egg size, loaded by belt conveyor on shipboard and unloaded at the plant site by especially designed clamshell bucket.

The crusher and quarry equipment will be electrically driven with power from the company's own plant which will be installed. Electrically operated shovels will load the rock in the quarry. A force of some 30 men will be employed on the island operations.

The new Seattle plant will be of steel and reinforced concrete construction. The wet process of grinding will be used in the mill and the latest designed machinery installed for dust collection.

Seattle's new cement plant, under investigation and analysis by company officials for several years, will take about one year to build. Pacific Coast company engineers are primarily responsible for the design and will supervise construction. The call for bids on the work will be issued from and considered in the Seattle office.

Associated with the Pacific Coast company in formation of the Pacific Coast Cement Company is the Cowham Engineering company of Chicago. The engineering concern will be represented on the directorate of the cement company by John L. Senior, its president. Mr. Senior will have general supervision of the plant and will act in an advisory capacity after completion.

The annual payroll of the local plant will be approximately $300,000. Sale of the product will be about one-third in Seattle, the remainder being distributed through Pacific Coast Coal Company dealers and by others throughout the Northwest. Production costs are forecast by company officials to be the lowest of any similar plant in this section. Five railroads are nearby.

The western Washington field is now served by two cement plants, one with capacity of 900,000 barrels and the other with 1,400,000 barrels a year. Assuming no expansion in demand, and all plants getting a proportionate share of the total consumption, all three plants, as soon as Pacific Coast plant is operating, would be running at, roughly, 62½ per cent capacity.

Normal consumption of cement in western Washington, which is the primary field of the Pacific Coast Cement Company, has been about 2,000,000 barrels in recent years, with 1927 consumption estimated at 2,100,000. Puget Sound basin consumed 1,753,000 barrels in 1926, with Seattle, Tacoma and Everett consuming 1,450,000 barrels of this. Seattle, with a population of 435,000, consumes from 600,000 to 730,000 barrels of cement a year. Pacific Coast Cement Company's nearest competitors are 100 miles from Seattle with a rail haul to market.

A $2,000,000 bond issue is also announced for public offering, being secured by a first mortgage on the proposed operations and guaranteed as to principal and interest by the Pacific Coast company, the parent organization, endorser. The issue is underwritten by Taylor, Ewart & Company, Inc., Geo. H. Burr, Conrad & Broom, and the Marine National Company, the latter two companies of Seattle. The bonds will be offered at 98½ to yield 6.50 per cent and will mature in December, 1942.

The officers of the cement company will be the present executives of the Pacific Coast Company and its subsidiaries. They are Walter Barnum, president; E. C. Ward, first vice-president; N. C. Moore, second vice-president; Wylie Hemphill, general sales manager.

Trinity Company Begins Operation of Third Plant

New Plant Located in City of Houston; Receives Raw Materials by Barge; Producing 2000 Barrels Daily; Foundations in for 300 Per Cent Increase

The third plant of the Trinity Portland Cement Company, at Houston, Texas, was put into operation recently. Design and mechanical operation are much like those of the Fort Worth plant of the Trinity company.

The plant covers about twenty acres of ground in the principal business district of the city.

Comprising the plant are a steel and concrete raw material storage, kiln building, general building containing machine shop, stockroom, switchboard gallery, other electric power apparatus, air compressors, etc., all built of steel and concrete. The eight-tank silo cement storage with sack house is of concrete construction and has a capacity of 150,000 barrels. Other structures are eight concrete slurry tanks, concrete office building, the Houston general office, plant offices and Houston sales office and laboratory.

Shells from Galveston Bay and shale from the San Jacinto river are used by the plant, which manufactures by the wet process. The shell is bought on contract delivered at the firm's docks. Shale is secured from land owned by the company. It is handled direct from deposit to barges and delivered by barge direct. A Northwestern crawler type shovel with a ¾-yard clam shell bucket quarries the shale.

Arriving at the dock, barges are unloaded by a 25-ton American Hoist and Derrick crane, a crawler-type equipped with a 1½-yard Hayward clamshell bucket. The crane, with a 60-foot boom, unloads directly from 300-ton barges to raw material storage, making possible the unloading of approximately 2000 tons of raw materials daily. The shale, shell, gypsum and clinker storage building is a steel and concrete structure 100 by 400 feet. A 12-ton Harnischfeger electric overhead grab bucket crane with a 4-yard Hayward bucket handles all materials to bins.

The machinery installation is composed of a 11 ft. 3 inch by 300 ft. Traylor kiln, feeding into an 8 ft. by 80 ft. Traylor cooler. An 8 by 40 ft. 3 compartment Traylor mill is used for raw grinding, and a similar size and make of mill for finish grinding.

A 900 h. p. General Electric supersynchronous motor, direct connected to the mill through flexible couplings, operates each mill. Compartment mills, cooler and kiln were purchased from the Traylor Engineering and Manufacturing Company, Allentown, Pa.

The Heine Chimney Company erected a tapering, reinforced concrete kiln chimney 300 feet high.

Motors were furnished by the General Electric Company, transformers by the Kuhlman Electric Company; switchboard by the Westinghouse Electric and Manufacturing Company; piping, valves, etc., by the Crane Company. The Houston Lighting and Power Company furnishes electric power. Gas used for clinker burning is purchased from the Houston Natural Gas Company.

Provision has been made in the layout and foundations so that a future daily capacity of 8,000 barrels may be attained. For the time being, however, 2,000 barrels will be produced. Good light, ventilation, and substantial construction have been obtained.

O. V. Bartholomew, general superintendent of the company, was the designer and superintendent of construction of the plant.

Dewey Plant to Have New Kiln

A third kiln has been contracted for by the Dewey Portland Cement Company for its Buffalo, Iowa, plant. This will be one unit in a $300,000 addition which will increase the capacity from 3,000 to 5,000 bags a day.

Ideal Declares Extra Dividend on Common Stock

The Ideal Cement Company declared its usual Christmas extra dividend of $1 on its common stock to be paid December 23. One dollar and seventy-five cents a share was paid on its preferred January 1. The annual meeting will be held January 25.

$60,000,000 Is New Capital Stock of Lehigh

At their meeting on December 10th, Lehigh Portland Cement Company at Allentown, stockholders voted favorably on the proposed increase of the capital stock of the company from $30,000,000 to $60,000,000. Three hundred thousand shares of 7 per cent cumulative preferred stock of the par value of $100 each will be issued.

No action was taken as to the disposition of the increase in capital.

Canada Company to Spend Million Dollars in Expansion

Expansion of the Winnipeg plant of the Canada Cement Company to the extent of an expenditure of $1,000,000 is looked for as a result of a proposed mine development known as Flin Flon.

The company will supply the cement for the Flin Flon work. This includes construction of a smelter and dams at the water power plant.

Construction of additions to the plant and adding of equipment began early in December.

New Missouri Plant Is Half Completed

The new plant of the Missouri Portland Cement Company, adjacent to the older plant, at Prospect Hill, in North St. Louis, on December 1st was about 50 per cent completed. It is designed especially for the production of quick-hardening cement. The annual capacity will be 600,000 barrels.

Fort Collins Plant Produces First Cement on Dec. 1

The first bag of cement was produced on November 25th at the Fort Collins plant of the Colorado Portland Cement Company. Secretary-Manager J. R. Morse, of Denver, was present and lighted the first fires under the kiln. The first bag of cement was produced on December 1st, when the public was invited to visit the plant.

Through December the plant was run by the construction crew, which is giving way on December 31st to the regular operating staff. The latter works on a three-shift basis. Daily capacity is placed at 3,500 bags. Ira Dilts has been appointed manager.

J. E. Zahn, of United States Portland Cement Co., Honored

J. E. Zahn, secretary of the United States Portland Cement Company, has been selected as a member of the finance committee of the Denver Chamber of Commerce. The committee will act in a consultatory way both in business and municipal expenditures.

Vice-President of Signal Mountain Dies

James L. Caldwell, 66, vice-president of the Signal Mountain Portland Cement Company and a director in the Florida Portland Cement Company, died at his home in Chattanooga, Tennessee, on November 19th.

Maryland Plant Begins $750,000 Changes

Work has begun on improvements costing $750,000 at the Hagerstown (Md.) plant of the North American Cement Company.

Waste heat equipment is being supplied by the Edge Moor Iron Company, Edge Moor, Del., the Greene Fuel Economizer Company, Beacon, N. Y., and the Foster-Wheeler Corporation of New York City.

Concrete and other construction work is being done by the J. B. Ferguson Company, Hagerstown. The General Electric Company, Schenectady, N. Y., is supplying the electrical equipment. The Worthington Pump and Machinery Corporation, Harrison, N. J., and New York City, is supplying the condensing equipment. All piping is by W. K. Mitchell Company, Philadelphia, Pa.

Monolith Backing New Texas Plant to Use Shells

The Monolith Portland Cement Company, Los Angeles, California, is interested in a cement plant to be located at Aransas Pass, Texas. Use of unlimited quantities of mud shell on the Texas coast has been contracted for. This calls for a royalty payment of 4 cents a ton on mud shell. It stipulates that a minimum of 100,000 tons of shell must be used annually and that within three years operation shall have been started of a plant turning out not less than 1800 barrels of cement daily.

Five thousand dollars have been deposited with the state and $1,000 will be paid annually until the contract is complied with, when the money will apply on shell purchases.

It is planned to ship cement out of Texas by water.

Interested in the project are Will J. Tucker, game, fish and oyster commissioner of Texas, Fred Robertson, Los Angeles, California, and Coy Burnett, of Monolith.

1927 Bessemer Interest More Than Quadrupled by Profit

Net profits available for bond interest and federal taxes of $538,554 for the nine months ending Oct. 31 are reported by the Bessemer Limestone & Cement Co. This is equal to 4.41 times the bond interest for the period. Net remaining for the Class A stock after interest and taxes was $360,679 and this is equal to $7.21 a share on 50,000 shares upon which dividends of $3 a year are being paid.

This compares with $5.07 on the Class A stock for all of 1926 and leaves $2.48 a share for the Class B stock. In the third quarter, it is understood, $4.38 a share was earned.

Universal Begins Work on Cleveland Plant

According to reports the Universal Portland Cement Company has started work on its new $2,000,000 plant at Cleveland. The carrying out of the plans was delayed for a period of almost two years.

When the land was first acquired the city entered into a deal with the company by which its holdings were amalgamated through a plan to straighten the river at the proposed site, the company deeding land needed.

Progress Being Made on New Ash Grove Plant in Nebraska

The Ash Grove Lime & Portland Cement Company of Kansas City, Missouri, has started work on a large new portland cement plant at Louisville, Nebraska.

According to L. T. Sunderland, president of the Ash Grove Company, the new plant will have an initial production of three-fourths of a million barrels annually, The total investment at Louisville will be more than two million dollars. More than 200 men will be employed.

The properties acquired in the vicinity of Louisville include several stone quarries, which had been operated for many years, and additional tested stone lands containing raw material sufficient for one hundred years of capacity operation of the plant.

The plant will be built on a site overlooking the Platte river at the junction of the Chicago, Burlington & Quincy and Missouri Pacific railroads, and unusually adequate shipping facilities will thus be provided.

Actual work on the new plant began early in August with excavating, and the Burlington railroad already has its tracks laid adjacent to the plant site.

The plans of the Ash Grove Company provide for the construction of houses for employees. A wooded tract on the heights overlooking the Platte river will be laid out to incorporate the best features of modern landscaping, comfortable homes, and an up-to-date water and sewerage system.

The Louisville plant will be owned and operated by a Nebraska corporation under the name Ash Grove Lime and Portland Cement Company of Nebraska, a subsidiary of the Kansas City company.

West Penn Company Makes Additions to Plant

The West Penn Portland Cement Company is enlarging its plant near Butler, Pennsylvania, by adding two wet mills and one dry mill, as well as one new kiln. When completed, the plant will have four wet mills and two dry mills.

American Portland Cement Co. May Manufacture Concrete Masonry Units

That the American Portland Cement Company, at Los Angeles, California, is to enter the concrete masonry field is seen in the report that options to three sites in the industrial district of the city have been obtained. These options cover a tract of eight acres on a proposed lease of 49 years at a stated rental of $515,000, a 10-acre block at a stated figure of $227,000, and a 9½-acre site at a total rental of $528,000 on a 49-year lease.

The locations are being considered by the company as sites for plants to manufacture building block under the Houghton building construction process, to which the concern holds territorial patent rights.

Senior Visits Tampa Plant and South

John L. Senior, president of the Cowham Engineering Company, Chicago and of the Florida Portland Cement Company of Tampa, spent two or three days in the vicinity of the Tampa plant late in November. Mr. Senior and his party, composed of R. N. Cowham and John A. Esmond of the Cowham Engineering Company and John L. Wildes, representing E. H. Rollins and Sons, investment bankers, and S. W. Storey, a director of the Tampa company, were on a tour of inspection to study Florida conditions and to visit the new Tampa plant, recently placed in operation. This was Mr. Senior's first visit since the plant began production.

Mr. Senior was reported to be well pleased with the operation of the plant and with its reception by the people of Tampa and Florida.

Before leaving for the South, Mr. Senior announced that negotiations had been completed for the purchase of 27 acres of land at Hookers Point, including the present plant site, from the Seaboard Air Line Railway. The price was not revealed. The land had been leased from the railroad previous to its purchase.

At a special stockholders' meeting in Chicago, it was announced that proceeds of a $1,750,000 first mortgage, 6½ per cent, sinking fund gold bond issue would be used partly in payment of the land and to reimburse the company for capital expenditures connected with the completion of the plant, equipment, and for additional working capital. The financing is through E. H. Rollins & Sons, and A. B. Leach & Co. Inc.,

Sale of the bonds was announced on November 29th. They are priced at 99 and accrued interest, to yield over 6.70 per cent.

Southwest Plant Shipments Reported by Cement Bureau

The Kansas City Bureau, serving western Missouri, Nebraska, Kansas, Arkansas, Oklahoma and the Texas Panhandle, states that the mills reporting to it shipped approximately 8,750,000 barrels of portland cement into these states during the first eleven months of 1927, as compared with approximately 9,000,000 barrels in the same period of 1926.

Monthly statistics show that with few exceptions the building permits in the larger cities of this territory are considerably lower in 1927 than in 1926.

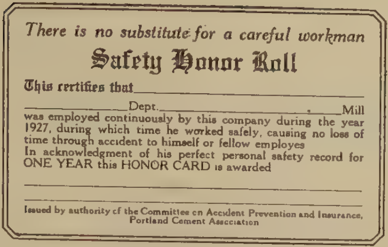
Government reports show that for these same eleven months the consumption in Arkansas and Oklahoma was in excess, while that of the other states above named was a decrease, compared to the same period in 1926.

The large stocks of portland cement which many of the mills serving this territory had on hand the first of this year, and indifferent demand during the first half thereof, enforced curtailment of operation to an extent that the mill average over the territory has been approximately two-thirds capacity.

Sub-Contracts for Missouri Plant Awarded

The following sub-contracts have been awarded for the construction of the $2,000,000 plant of the Missouri Portland Cement Company, St. Louis: Motors and switchboard, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania; transformers, Moloney Electric Company, St. Louis; motor generator sets, Chandeyson Electric Company, St. Louis; concrete foundation and slurry basins, Fruin-Colnon Contracting Company, St. Louis; concrete piles, Smith & Brennan Concrete Pile Company, St. Louis; hammer mills, Dixie Machinery Co., St. Louis; rock feeders, Stephens-Adamson Mfg. Co., St. Louis; skip hoists, R. H. Beaumont & Co., Philadelphia, Pa.; air compressors, Pennsylvania Pump & Compressor Company, St. Louis; fans, Buffalo Forge Company, St. Louis; kiln, Traylor Engineering Company, New York City; speed reducers, Falk Corporation, Milwaukee, Wisconsin; coal crusher, Jeffrey Mfg. Co., Columbus, Ohio; automatic scales, Richardson Scales Co., Clifton, N. J.; cement pumps, Fuller-Lehigh Co.; coal pumps, Fuller-Lehigh Company, Fullerton, Pa.; Wilfley pumps, Mine and Smelter Supply Company, New York City; grinding machinery, F. L. Smidth & Co., New York; concrete chimney, John V. Boland Construction Company, St. Louis.

Several contracts remain to be awarded. The Smidth company are also the engineers. The plant is to be ready for operation in April, 1928.



There is no substitute for a careful workman

Safety Honor Roll

This certifies that ______________________

______________ Dept. ______________________, ________ Mill

was employed continuously by this company during the year 1927, during which time he worked safely, causing no loss of time through accident to himself or fellow employes

In acknowledgment of his perfect personal safety record for ONE YEAR this HONOR CARD is awarded

____

____

Issued by authority of the Committee on Accident Prevention and Insurance, Portland Cement Association

One of these "Safety Honor Rolls" will be awarded to every workman who went through the year without being in or contributing to an accident. This certificate has a light green background, with "1927" outlined on it

A board of award has been formed to which cases of bravery in plants will be reported. This board will review cases and give recognition in some form or another

San Antonio Gives Contract for Finishing Mill Work

The San Antonio Portland Cement Company has awarded a contract for structural steel framing and bins for the finishing mill at Cementville. W. E. Simpson Co., San Antonio, are the engineers and the contract was awarded to the Houston Structural Steel Company.

Colorado Cement Plant Re-opens After Repairs

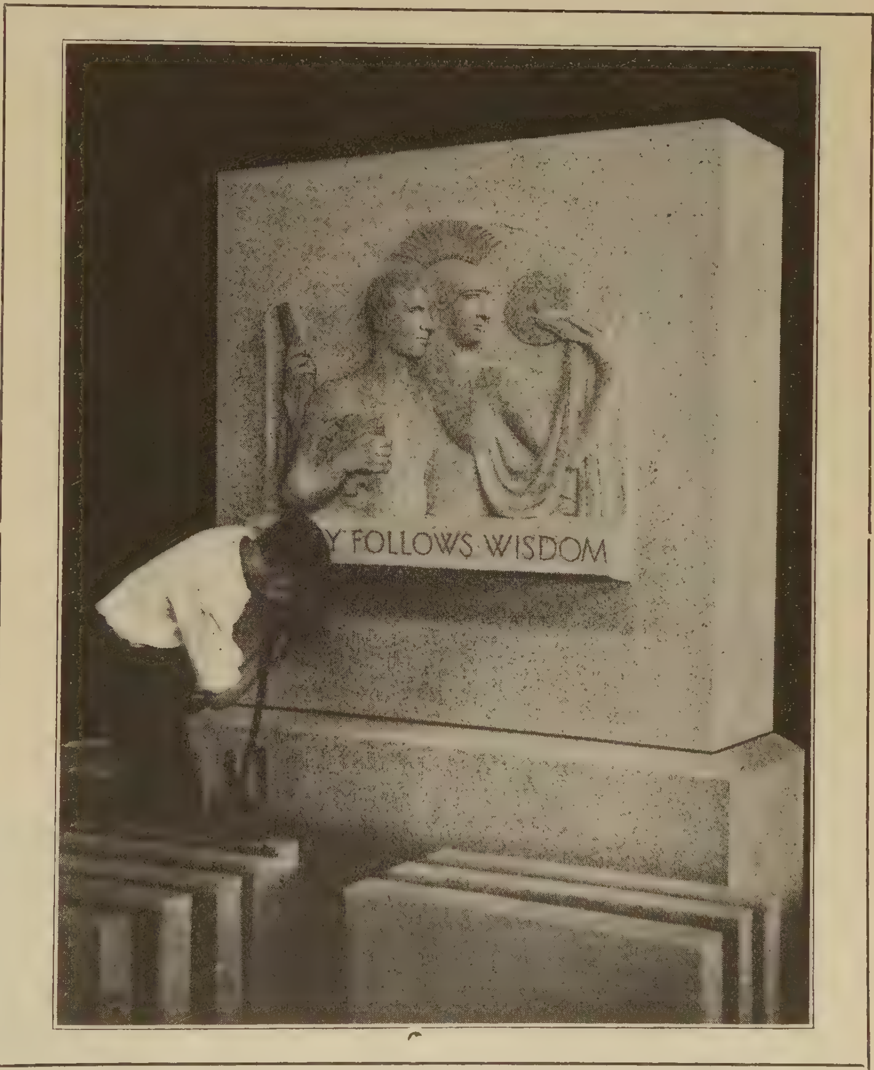
Shutting down on November 19 for the usual annual repairs, the plant of the Colorado Portland Cement Company at Portland, Colorado, was reopened December 3rd, with 320 men employed. The report current was that the plant shut down because of the coal strike, but company officials say that the coal strike merely made the shutdown an advantageous time for repairs which were necessary.

Secretary-Treasurer of Diamond Co. Dies

Lyman A. Reed, 67, secretary and treasurer of the Diamond Portland Cement Company, died suddenly on November 24th, at his home at Lakewood, Ohio.

Death was attributed to heart disease. Mr. Reed, who had lived in Cleveland all his life, was a director of the City Savings & Loan Co., the Cleveland Mortgage Co. and a member of the Cleveland Athletic Club and Lakewood Elks.

Funeral services were held from the family residence.



The coveted safety trophy, which will very likely be awarded to thirteen plants for 1927. To avoid exorbitant freight charges they will be cast hollow. Plants with 100 per cent safety records for 1927 already having trophies will have theirs rechiseled

First Aid Teams Organized by Union Bridge Plant

Impressed by the value of first aid as demonstrated at the International First Aid and Mine Rescue Contest held recently in Pittsburgh, the Lehigh plant at Union Bridge, Maryland, has organized first aid teams, each composed of a captain and five men.

Three teams, captained by Howard Gray, Wm. Selby, and C. E. Selby, have been organized.

The international contest was the sixth, and was held under the auspices of the United States Bureau of Mines. Forty-seven first aid teams from thirteen states, and eighteen mine rescue teams from six states participated.

L. T. Bachman, Pacific Consulting Chemist, Dies

Llewellyn T. Bachman, consulting chemist with the Pacific Portland Cement Company, died on November 19th while on a train near Harrisburg, Pa. He was 58 years of age and apparently in the best of health.

Twenty-five years ago Mr. Bachman joined the Nazareth Portland Cement Company and later the Santa Cruz Company, at Santa Cruz, California. He became connected with the Pacific company in February, 1926.

Regional Safety Meeting Held at Allentown

The Eastern Pennsylvania Safety Conference was held at the Americus Hotel at Allentown, Pennsylvania, on Tuesday, December 6th. Major Henry A. Reninger, president of the Lehigh Valley Safety Council and vice-president of the National Safety Council, was general chairman in charge of the arrangements.

Talks on accident prevention in the home and on the street occupied the morning session.

L. A. DeBlois, chief engineer of the National Bureau of Casualty and Surety Underwriters, New York City and a former president of the National Safety Council, presided at the afternoon session. The latter was opened with a discussion by Chas. W. Waters, secretary, Dept. of Labor and Industry, State of Pennsylvania, on "Relations of the Department with Industry."

At this session also E. W. Beck, vice president of the National Safety Council, spoke on "Selling Safety to the Man on the Job." "Accidents—A National Waste" was the subject on which John B. Grier, personnel director of the American Car & Foundry Co., talked. F. J. O'Connor, welfare superintendent of the E. I. duPont de Nemours & Co., discussed "Every Foreman a Safety Director."

Col. E. M. Young, president of the Lehigh Portland Cement Company was toastmaster at the informal dinner in the evening. An inspirational address was delivered by Col. Theodore B. Appel, M. D.

Petoskey Celebrates Fourth Safety Meeting

Its fourth annual safety first banquet was held by the Petoskey Portland Cement Company on Wednesday, December 7th. Two hundred and fifty employees and guests attended. John L. Galster, treasurer and general manager, was toastmaster. Music was furnished by two bands.

International Lowers Price 20 Cents in Birmingham

The Alabama Portland Cement Company, a subsidiary of the International Cement Corporation, on December 4th announced a reduction of 20 cents a barrel in the mill base price of cement at its Birmingham plant, effective December 5. Mr. J. W. Johnston, vice-president of the Alabama Company, who made the announcement, said:

"This reduction has been made in an effort to protect the Alabama company's trade and its dealers against an unsettled condition that has been created throughout the territory served by the Birmingham mill, largely through the introduction of foreign cement.

"This foreign cement is manufactured under conditions unacceptable to American standards of living which allow it to unfairly compete with the domestic product. Its sale here is in effect an evasion of our immigration laws and its introduction at the ports has had the effect of unsettling the industry throughout the entire territory to a dangerous extent.

"While this reduction is a serious sacrifice and is made primarily to protect the cement company's dealers, we believe it will materially benefit producers of domestic coal, power, cotton, explosives and the railroads, and it is hoped it will correct the present highly unsatisfactory conditions within the industry."

Eastern Plants Ask Revised Freight Rates

Pennsylvania, New York, and Maryland cement producers, including the Alpha Portland Cement Company, in November began their fight before the United States Commerce Commission for revised freight rates.

The first witness was Walter Young, of Atlas. He was on the stand but ten minutes, testifying to the discontinuance by railroads for various lines when the railroad counsel raised objections.

Young was testifying to the curtailment of service from Northampton by the Erie and the Lackawanna, causing shipments from Jersey City to New Rochelle to be moved via the Poughkeepsie bridge, when it was demanded where his figures were secured. Young said he got them from the railroads themselves, whereupon railroad counsel objected on the ground that he was giving hearsay testimony.

Penn-Dixie Entertains North Carolina Dealers

The Chattanooga office of the Pennsylvania-Dixie Corporation was host to thirty-four North Carolina dealers on October 26th at the plant. Following the drive to Richard City, the party visited the Dixie Portland Memorial School. Lunch was served at a local inn, followed by an inspection of the plant and quarries accompanied by Superintendent Legg. A banquet, accompanied by entertainment, was served in the evening.

On November 22nd and 23rd, three members of the State Highway Engineering Department of the State of Georgia, were accompanied to the plant by Mr. J. M. Wilkerson, district manager of the Atlanta office. The party was escorted through all plant departments and then through the Dixie Memorial school. On the morning of the 23rd, the Chattanooga office was visited.

Penn-Dixie Director New President of American Bankers Association

Thos. R. Preston, a director of the Pennsylvania-Dixie Cement Corporation, was formally elected to the presidency of the American Bankers Association, at a general session held at Houston, Texas, on October 26th. Mr. Preston was also for many years a director of the old Dixie cement company.

He is also president of the Hamilton National Bank, of Chattanooga, Tennessee.

Northwestern Plant Near Seattle Ready Soon

The 2000-barrel capacity cement plant of the Northwestern Portland Cement Co., 40 miles north of Seattle on the Great Northern railroad will be ready for operation by the first of the year, it is estimated by company officials.

A contract for electrical machinery costing about $75,000 has been given to the General Electric Co.

The president is Geo. MacDonald; Dr. W. J. Kerr of Corvallis, Oregon, vice-president; and C. T. W. Hollister, secretary. John Hastie, of the Sound Construction & Engineering Co., of Seattle is the Washington director.

Cement Statistics for November

THE usual seasonal trend was shown in November by decreases in production and shipments and increases in stock as compared with October.

In the following statement of relation of production to capacity, the total output of finished cement is compared with the estimated capacity of 154 plants.

Relation of Production to Capacity

(Figures Represent Per Cent)

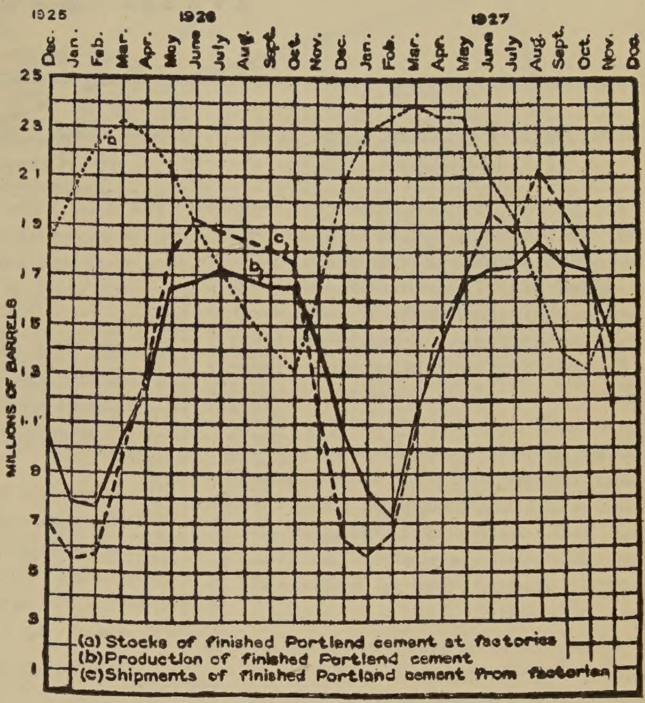
Period	November 1927	November 1926	Oct. 1927	Sept. 1927	August 1927
The month	75.9	79.3	87.4	92.6	94.5
The 12 months ended	73.7	76.9	73.6	72.3	74.0

Estimated Clinker (Unground Cement) at the Mills at End of Each Month, 1926 and 1927

(Figures Represent Barrels)

Month	1926	1927
January	9,074,000	9,989,000
February	10,931,000	11,943,000
March	12,290,000	12,997,000
April	12,967,000	13,335,000
May	11,695,000	12,514,000
June	10,144,000	10,926,000
July	8,604,000	9,609,000
August	7,362,000	7,887,000
September	6,112,000	6,490,000
October	5,370,000	*5,957,000
November	5,748,000	6,380,000
December	7,799,000	—

*Revised.



Production, Shipments and Stocks of Finished Portland Cement, by Months and by Districts, 1926 and 1927, and Stocks in October, 1927

Month	Production 1926	Production 1927	Shipments 1926	Shipments 1927	Stocks at end of month 1926	Stocks at end of month 1927
January	7,887,000	8,258,000	5,674,000	5,968,000	20,582,000	22,914,000
February	7,731,000	7,377,000	5,820,000	6,731,000	22,385,000	23,560,000
March	10,390,000	11,452,000	9,539,000	11,083,000	23,236,000	23,922,000
First quarter	26,008,000	27,087,000	21,033,000	23,782,000	—	—
April	12,440,000	14,048,000	12,965,000	14,350,000	22,710,000	23,654,000
May	16,510,000	16,701,000	17,973,000	16,865,000	21,255,000	23,503,000
June	16,866,000	17,224,000	19,134,000	19,761,000	19,000,000	20,972,000
Second quarter	45,816,000	47,973,000	50,072,000	50,976,000	—	—
July	17,134,000	17,408,000	18,812,000	18,984,000	17,301,000	19,397,000
August	16,995,000	18,315,000	18,583,000	21,411,000	15,718,000	16,292,000
September	16,571,000	17,505,000	18,087,000	19,828,000	14,188,000	13,996,000
Third quarter	50,700,000	53,228,000	55,482,000	60,223,000	—	—
October	16,596,000	17,174,000	17,486,000	*18,105,000	13,334,000	*13,141,000
November	14,193,000	14,449,000	11,276,000	11,619,000	16,243,000	15,971,000
December	10,757,000	—	6,432,000	—	20,679,000	—
Fourth quarter	41,546,000	—	35,194,000	—	—	—
	164,070,000	—	161,781,000	—	—	—

*Revised.

Commercial District	Production—November 1926	Production—November 1927	Shipments—November 1926	Shipments—November 1927	Stocks at end of November 1926	Stocks at end of November 1927	Stocks at end of Oct., 1927*
Eastern Pennsylvania, New Jersey, Md.	3,617,000	3,345,000	3,356,000	3,008,000	2,697,000	3,726,000	3,389,000
New York	820,000	804,000	609,000	740,000	883,000	1,205,000	1,142,000
Ohio, Western Penn., and West Virginia	1,157,000	1,542,000	1,067,000	986,000	2,151,000	2,069,000	1,513,000
Michigan	1,227,000	1,181,000	781,000	757,000	1,486,000	1,501,000	1,077,000
Wisconsin, Illinois, Indiana, and Kentucky	1,930,000	1,909,000	1,143,000	1,284,000	2,084,000	1,510,000	885,000
Virginia, Tenn., Ala., Ga., Fla.,† La.‡	1,290,000	1,452,000	1,233,000	1,326,000	1,124,000	1,304,000	1,178,000
Eastern Missouri, Iowa, Minn., and So. Dak.	1,310,000	1,411,000	602,000	677,000	2,317,000	1,724,000	990,000
Western Missouri, Nebraska, Kansas, Okla.	821,000	883,000	739,000	830,000	1,538,000	1,266,000	1,213,000
Texas	402,000	525,000	427,000	543,000	381,000	252,000	270,000
Colorado, Montana, and Utah	200,000	176,000	142,000	175,000	454,000	315,000	313,000
California	1,154,000	1,048,000	972,000	1,103,000	662,000	770,000	825,000
Oregon and Washington	265,000	173,000	205,000	190,000	466,000	329,000	346,000
	14,193,000	14,449,000	11,276,000	11,619,000	16,243,000	15,971,000	13,141,000

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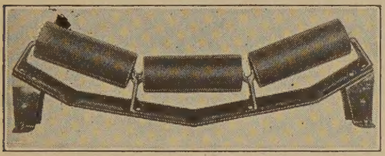
*Revised. †Began producing September, 1927. ‡Began producing June, 1927, and shipping July, 1927.

Mill Equipment

New Anti-Friction Cast Iron Pulley

The Stearns Conveyor Company of Cleveland has put out a new anti-friction cast iron pulley whose outer surface is made of chilled iron. This surface is extremely hard and will stand the most severe wear under a wide range of conditions from extreme heat to cold. It has always been difficult to put a good chilled iron surface on a small casting, particularly a shell, but the company now manufactures an idler pulley having a good depth of chill. It has a denser and tougher material than a common chill, capable of receiving a very high polish and contains the most wear-resisting material that is commercially practicable today.

Within, the metal grades evenly to grey iron, giving the pulley a hard, smooth, wear-resisting surface with a relatively tough inside. The one-piece closed end design makes these pulleys practically unbreakable even under the severest service.



Allis-Chalmers Type "SSU" Centrifugal Pumping Units

The type SSU centrifugal pumping units recently developed by the Allis-Chalmers Manufacturing Company are combined motor and pump units of simple, compact, substantial design, the complete units being not much larger than a motor alone.

Both the pump and motor parts are built and guaranteed by the same manufacturer so there is no divided responsibility as well as insuring that the pump and motor ends are properly proportioned to work together as an efficient, reliable unit.

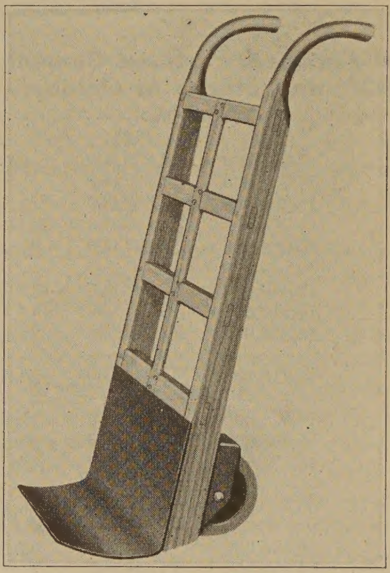
The unit is close coupled by fastening the pump impeller to one end of the liberal diameter extended motor shaft and the pump casing is bolted to a special integrally cast extension of one of the motor end housings. This makes the simplest possible construction and eliminates a base plate, coupling, and pump bearings and does away with the possibility of misalignment between the pump and motor.

New Bag Truck Is Launched by Bates Valve Bag

The Bates Valve Bag Company is backing the marketing of a new truck for handling cloth and paper bags. The extreme ease with which it is operated is its chief feature.

The bag truck wheels are equipped with ball bearings and heavy rubber tires to absorb shocks caused by rough floors. The truck is perfectly balanced when fully loaded.

The nose plate is a new type, of heavy steel, with a specially designed curved lip to permit rocking bags off the truck into orderly piles without rehandling. The breadth of the nose plate prevents bags piled straight up from slipping off. Surfaces next to the load are smooth, with no projections of any kind to mutilate bags.



Although built for hard wear, the truck weighs but 82 pounds complete.

Lawrence Installs Dust Collecting System

The Lawrence Portland Cement Company has begun the installation of a Norblo dust collecting system for its stone drier.

The drier was installed last spring, and as soon as the amount of dust to be collected was ascertained, plans were made to install the dust collecting system. Its efficiency is guaranteed at 99.5 per cent.

Westinghouse Displays New Designs at Power Show

At the New York Power Show held in December, the Westinghouse Electric and Manufacturing Company exhibited new designs of stoker and steam turbine equipment.

The stoker department displayed a turbo gear box for multiple retort stoker drive. This drive consists of a two-speed gear box with which is integrally combined a steam turbine and coal feed indicator. Any increment of speed from zero to maximum is easily obtained and simultaneous with the speed variations. The indicator shows at a glance at what rate (in pounds per hour) coal is being fed into the furnace.

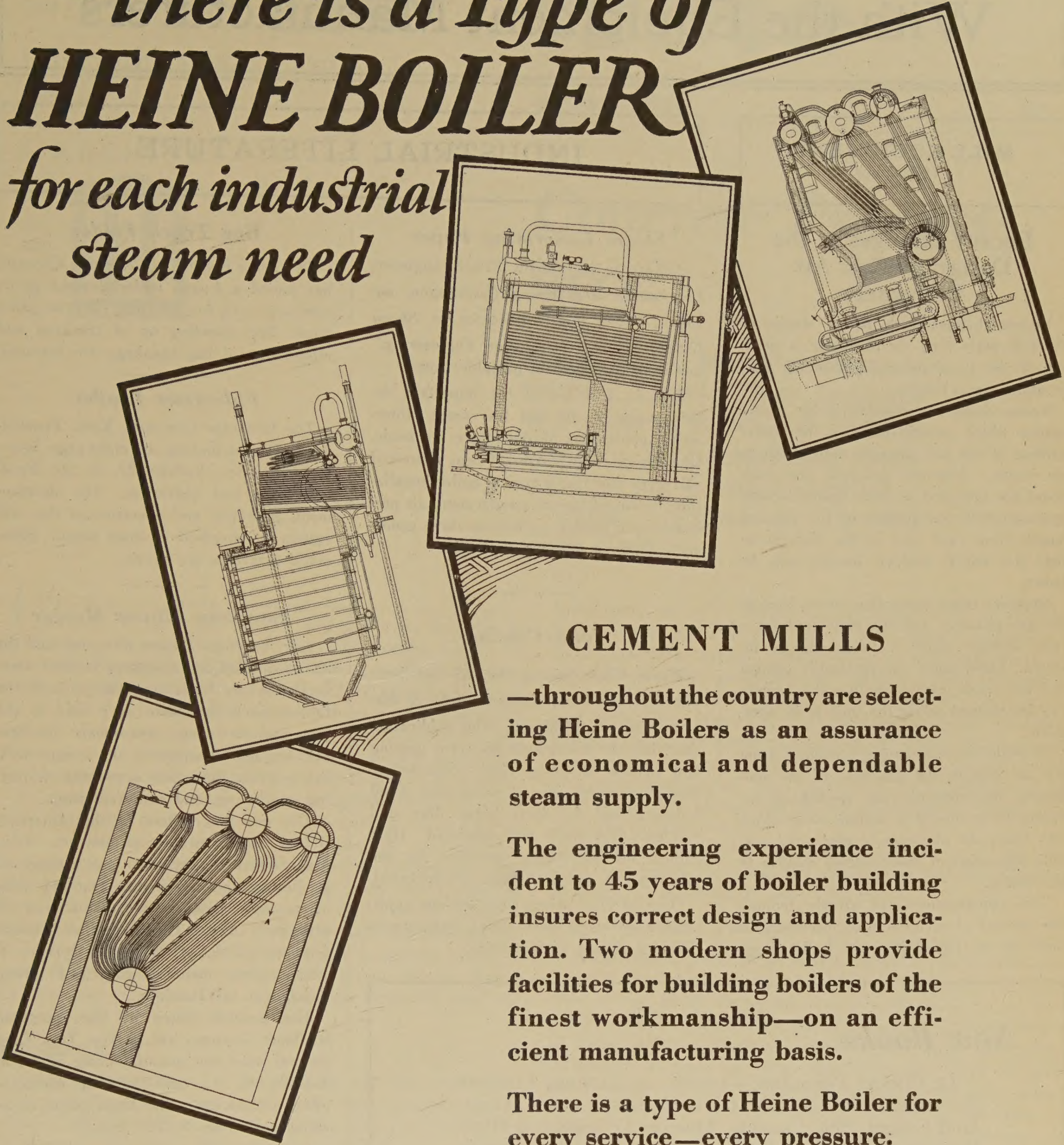
The South Philadelphia sales department exhibited a 200-k.w. geared turbine generator unit which is built in ratings from 75 to 500 k.w. These turbines, although primarily intended to drive either alternating current or direct current generators may be used to drive practically any apparatus within the range for which the gears are suited. These units are compact and accessible; they are built to withstand the hardest service with a minimum of operating attention. Their steam consumption rate is excellent. The oil-operated governor used is similar to that used on larger Westinghouse turbines. This governor makes it possible for the operator to vary the speed over a wide range while the turbine is in operation.

There was also exhibited a redesigned turbine for mechanical drive. This type of turbine is built in capacites from 5 to 75 b.h.p. It is admirably suited for driving circulating pumps, centrifugal boiler feed pumps, blowers and other rotary apparatus. It may be connected to the driven machinery either directly or through the medium of helical reduction gears.

Another feature of the Westinghouse exhibit was a new 3-k.w. direct-connected mechanical turbine generator unit for producing 125-volt direct current. This apparatus has been developed to meet the high-grade, small non-condensing steam turbine generator lighting set for use with oil rigs, steam shovels, isolated pumping plants and for general outdoor construction work.

Also exhibited was a 4-inch priming ejector. This ejector employs a group of nozzles arranged to secure maximum entraining effect of the relatively dense air which the ejector handles and are screwed into the bottom of a steel steam chest. The air inlet mixing chamber and diffuser are combined in one piece and made of cast iron.

—*there is a Type of* HEINE BOILER *for each industrial steam need*



CEMENT MILLS

—throughout the country are selecting Heine Boilers as an assurance of economical and dependable steam supply.

The engineering experience incident to 45 years of boiler building insures correct design and application. Two modern shops provide facilities for building boilers of the finest workmanship—on an efficient manufacturing basis.

There is a type of Heine Boiler for every service—every pressure.

HEINE BOILER COMPANY

International Combustion Building
200 Madison Avenue, New York

A SUBSIDIARY OF INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

With the Equipment Manufacturers

MILL EQUIPMENT
(Continued)

Recent Changes in the Design of C-E Air Preheaters

Recent changes made in the design of the C-E plate type air preheater, a product of the Combustion Engineering Corporation, are as follows:

Access doors are provided in the heater casing which permit blowing the entire surface of the gas passages with steam or air lances. Wherever possible, two such doors are provided in each heater located approximately one-quarter of the element length from each end of the element so that the entire heating surface can be blown.

Opposite these doors the spacer bars in the gas passages are cut away to form a lane through which a lance can be inserted. These doors can be readily opened and are small enough so that the heaters can be cleaned while the unit is in operation.

In order to eliminate any leakage from the air side to the gas side of the preheater, the elements are welded to the casing by means of a sealing strip which also holds the elements in place and permits expansion of the elements relative to the casing.

This construction also greatly reduces the amount of erection work necessary as there are no bolted joints to be lined up.

INDUSTRIAL LITERATURE

Steam Generating Paper

An article by Martin Frisch, engineer, *Combustion Engineering Corporation*, entitled, *"Aims and Tendencies in Steam Generation and Combustion Engineering,"* has been published in pamphlet form.

This is a review of the important developments of the last few years. Interesting predictions of the future are made. Illustrations show curves of heat recovered and work done for a typical boiler installation, details of burner arrangement, air preheater, and burner, as well as three generating units in prominent plants.

Jones Catalog

Worm Gear Catalog No. 35 has been issued by the *W. A. Jones Foundry & Machine Company*, Chicago. The publication describes the advantages of worm gearing and details of design and construction. Horsepower capacities of worm gear speed reducers and for both heavy duty and medium duty units are tabulated. Heat ratings for continuous operation for the two types of speed reducers are included.

Over 20 illustrations show various applications of worm gear speed reducers in different classes of industries.

Bag Truck Folder

The Bates Valve Bag Company, Chicago, has issued a 4-page folder devoted to its new bag truck for handling cloth or paper bags. The speeding up of trucking and elimination of bag breakage are featured.

Pulverizer Leaflet

The Hardinge Company, York, Pennsylvania, is distributing an eight-page loose-leaf pamphlet, *Bulletin* 27, on the *Hardinge* unit coal pulverizer. The development, principle, and operation of the unit system is described in some detail. Schematic diagrams are shown.

American Blower Merger

The American Blower Company and the *American Radiator Company* merged early in December. Each firm will work in the future much the same as it has in the past, as to name, personnel, business methods and management, the merger making possible important economies in buying, marketing, and manufacturing.

The executive offices of the American Blower Company are at Detroit, Mich. Manufacturing operations are carried on at Detroit and Cincinanti, O., and sales offices and agencies are maintained in principal cities. The Canadian Sirocco Company, Ltd., of Windsor, Ontario, is an associate, manufacturing and selling throughout the Dominion.

The general offices of the American Radiator Company are in New York City, general sales and manufacturing offices at Buffalo, N. Y., and western executive office at Chicago. The main plant is located at Buffalo, N. Y.

New Fahralloy Furnace

The Southern Manganese Steel Company, St. Louis, Missouri, expects to complete within the next few weeks, the addition of a new 500-pound electric melting furnace to its plant. This will be placed in a new building. Production will be confined to smaller and lighter design castings in Fahralloy, the heat and corrosion-resisting alloy.

This furnace will work as an auxiliary to the 3000-pound electric melting furnace now used.

New Books

LE CIMENT PORTLAND; CIMENTS DE LAITIER; CIMENTS ALUMINEUX; ET CIMENTS A HAUTES RESISTANCES. (Portland Cement, Slag Cements, Alumina Cements and High-Strength Portlands.) By E. C. Blanc and E. C. Eckel. 8vo, pp. 481, 4 folding plates, 190 text figures. Paris, 1927. Published by Charles Beranger, 15 rue des Saint Peres, Paris.

This volume, which has just made its appearance, contains a full discussion of modern methods of portland cement manufacture, special attention being paid to recent European developments. It is one of the first books, in any language, to adequately discuss the newer types of cement, including the alumina cements, the high early-strength portlands, and the quick-hardening slag cements, all of which have grown to importance since the publication of most of the standard texts on cement manufacture.